



Long Island Sound Interstate Aquatic Invasive Species Management Plan

Prepared for

New England Interstate Water Pollution
Control Commission
U.S. Environmental Protection Agency,
Long Island Sound Study
State of Connecticut
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DRAFT FOR PUBLIC COMMENT

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Executive Summary

Background

The introduction and spread of aquatic invasive species (AIS)¹ in an estuarine environment such as Long Island Sound (LIS) pose a serious threat to the ecology and biodiversity of native marine, estuarine, and brackish ecosystems and to the health and economic interests of the citizens of Connecticut, New York, and the Northeast region. Aquatic invasions pose difficult challenges to natural resource managers. Once introduced, populations of AIS may become self-sustaining. Effective AIS management requires on-going efforts devoted to the prevention of new introductions and to the eradication and/or control of existing populations to minimize their impact and spread. In marine systems, spread prevention, eradication, and control are often infeasible, although there are an increasing number of case studies where eradication has been successfully undertaken or is in process. Nonindigenous species have the potential to be introduced to new habitats through a variety of effective vectors, and to establish and spread rapidly (in some cases) due to a lack of physical or biological constraints. The range of AIS impacts is extensive and can include:

- Reduced diversity of native flora and fauna due to environmental effects such as increased predation, parasitism, competition and displacement, introduction of new pathogens, changes in genetic make-up, wildlife habitat alterations and degradation
- Degradation of water quality
- Economic impacts causing increased costs for services, products, infrastructure, or maintenance among commercial, recreational, and industrial users
- Increased threats to public health and safety
- Increased threats to proper functioning and maintenance of power generation utilities; increased costs for maintenance and operation

The Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990 created a Federal Aquatic Nuisance Species (ANS) Task Force in response to the invasion and subsequent spread of zebra mussels across the U.S. This legislation, as amended by the National Invasive Species Act of 1996, authorized and provided guidance for the development of state or interstate aquatic nuisance species management plans. Section 1204 of the Act enables Governors to submit comprehensive plans to the Federal ANS Task Force. Management plans are required to identify activities needed to prevent or control infestations and to reduce associated environmental and public health risks, in an environmentally sound manner. States with approved plans are eligible to request Federal assistance from the US Fish and Wildlife Service for up to 75% of implementation cost. At this time federal funding remains limited, but given the extent of damage caused by AIS, it is expected that the amount of Federal AIS funding that is available will increase over time.

Goal of the LIS Interstate AIS Management Plan

The goal of this effort, as developed by the LIS AIS Working Group, is that the States of Connecticut and New York, in collaboration with relevant federal agencies, academic institutions, and non-governmental organizations, will adopt and implement the Long Island Sound Interstate Aquatic Invasive Species Management Plan, in order to:

- prevent the introduction of new aquatic invasive species in the Long Island Sound estuary, and
- minimize the ecological, socioeconomic, and public health impacts of existing aquatic invasive species in the Long Island Sound estuary.

¹ Definitions of acronyms are provided in the List of Acronyms.

For the purposes of the Plan, the LIS estuary has been defined as the average summer extent of salt water intrusion, specifically the mesohaline limit (a salinity of 5 parts per thousand (ppt)) in all freshwater tributaries.

Approach for Developing the LIS Interstate AIS Plan

- Guidance developed by the Federal ANS Task Force was the primary reference (see http://www.anstaskforce.gov/state_guidance.htm). The LIS AIS Management Plan addresses required elements and is organized according to the Federal guidance document.
- The federally-approved Lake Champlain Basin Program Interstate ANS Plan was used as a guide for interstate plans, even though it is for a freshwater body. The state-approved CT ANS Management Plan and the 2005 final report of the New York State Invasive Species Task Force were also used for guidance.
- The LIS AIS Plan was developed by writers in concert with the LIS Interstate AIS Working Group, comprised of representatives from state and federal agencies, academic institutions, non-governmental organizations, business, and industry.
- The project was managed by the Connecticut Sea Grant College Program, University of Connecticut, and was funded by the New England Interstate Water Pollution Control Commission, on contract with the U.S. Environmental Protection Agency, Long Island Sound Office. Additional support was provided by Connecticut Sea Grant, the EPA Long Island Sound Study (LISS), and New York Sea Grant.
- The draft plan was reviewed by members of the LISS Science and Technical Advisory Committee.
- Public input was sought and obtained through presentations to the New York Marine Resources Advisory Council (MRAC), the LISS Science and Technical Advisory Committee, the LISS Citizens Advisory Committee; by posting the draft plan on the internet and broadcasting its URL and a request for comments to a number of list serves from throughout the region, and through public meetings.

Key Findings

- More than 50 non-native and 40 cryptogenic (uncertain if native or non-native) species have been identified in Long Island Sound.
- Potential pathways of introduction of non-native species to Long Island Sound may include transportation (hull fouling, ballast water, hull cleaning activities), aquaculture, live bait use by anglers, live seafood industry, aquarium industry / hobbyists, wind and currents, equipment (dredging equipment, nets, traps, dive and snorkeling gear), research facilities, and intentional introductions.
- While all introduced species impact local ecosystems in some way through the use of key resources (food, shelter, etc.), for management purposes, only those species which rise to the level of “invasive” (defined as those species likely to cause economic or environmental harm, or harm to human health) will be addressed.
- A risk assessment tool can be a helpful tool in determining if management may be warranted; risk management actions and policy will be specific to each organism.
- Risk assessments completed for two established species and ten species with the potential for introduction. *Hemigrapsus sanguineus* and *Grateloupia turuturu*, already established in Long Island Sound, were used to test the assessment process.
- Risk assessments completed for ten species with the potential for introduction resulted in 9 of 10 being rated as having a “high” risk potential (overall impact).
- A prioritization process was established for management, research, and outreach purposes. Established and some potential species were categorized according to the extent of the invasion and the degree by which current management capabilities can effectively control them or prevent further spread, as follows:
 - Class 1 (potential invaders, impacts expected to be severe)
 - Class 2 (newly-identified species)
 - Class 3 (established species with significant impact, some practical control techniques available)

- Class 4 (established species with significant impact but no known effective or practical control techniques available)
- Class 5 (established species, impacts unclear)
- Priorities for management actions, research, and outreach will focus on species in Classes 1, 2, and 3, with an emphasis on preventing new introductions or the spread of established invasive species, and employing control strategies as feasible.
- Although control or eradication options for species introduced into a marine or estuarine system are more limited than for freshwater or terrestrial systems, recent case studies from the U.S., New Zealand, and other parts of the world demonstrate that control / eradication can be successfully undertaken.
- Coordination among Connecticut, New York, federal, and regional entities through management, research, and outreach, is crucial to preventing and mitigating the impacts of aquatic invasive species in Long Island Sound.

Conclusions

- Aquatic Invasive Species (AIS) are a regional problem, as well as a global problem. Rates of introduction are increasing and all varieties of aquatic environments are affected. As a regional problem, AIS should be addressed regionally—hence this plan.
- AIS in Long Island Sound can result in significant ecological, socioeconomic, and management costs; the response to AIS in LIS needs to be coordinated among the States of Connecticut and New York, the federal EPA, and myriad regional agencies, organizations, and institutions.
- Prevention of future anthropogenic introductions of AIS into Long Island Sound was identified as the primary objective outlined in this plan.
- Established and potential AIS in Long Island Sound should be assessed in an unbiased manner to determine the appropriate management class to which they should be assigned. Many non-native species in Long Island Sound may not become invasive post-introduction, and limited resources must be focused on addressing those species with the greater likelihood of causing harm to the environment, e.g., those in Management Classes 1, 2, and 3.
- Introduction and spread of all AIS can be reduced through education and/or regulation (with adequate outreach and coordination). Education, regulation and enforcement are the first and most important lines of defense against the further spread of established AIS and the introduction of new AIS.
- Existing laws and regulations pertaining to AIS need to be reviewed and updated periodically, and an effort undertaken to have complementary Connecticut and New York policies and regulations with respect to AIS in Long Island Sound wherever possible.
- Improved communication and coordination among regulating entities and increased enforcement of existing laws and statutes are needed.
- While this plan does not recommend the hiring of an invasive species coordinator, the successful implementation of this plan will require dedicated program staff to work together to coordinate and provide the level of education, regulation, enforcement, rapid response, monitoring, control and management necessary to address AIS issues in Long Island Sound.

Recommendations

Recommendations are organized under one goal and eight key objectives (see Sections 4 and 5). Recent (2006, 2007) activities are documented, along with short-term (<2 years) and long-term (> 2 years) components. Successful completion of both short and long-term strategies and actions will depend on identifying and securing the necessary resources. Wherever possible, funding already secured is identified.

1. **Coordination:** Coordinate AIS-related activities of relevant state and federal authorities for Long Island Sound.

- a) Establish a coordinating committee
 - b) Coordinate with Connecticut and New York State ANS Plans, and develop risk assessment, management, and policy procedures
 - c) Establish an annual work plan and the means for evaluating progress
 - d) Coordinate regionally
2. **Funding:** Secure adequate funding and staff to implement AIS management objectives for Long Island Sound
 - a) Identify and secure funding
 3. **Prevent Future Anthropogenic Introductions** into Long Island Sound
 - a) Assess introduction risks
 - b) Minimize introductions through marine commerce, marine recreation, education and research, the live seafood trade, and habitat restoration
 4. **Detect and Monitor** new occurrences, range expansions, and existing populations of AIS in Long Island Sound
 - a) Strategize early detection, monitoring, and assessment
 - b) Standardize a survey protocol
 - c) Implement a monitoring program
 - d) Create library of existing AIS
 - e) Establish an information service
 5. **Initiate Risk Management** for all new invasions in Long Island Sound and for existing AIS in LIS as appropriate
 - a) Develop / adopt rapid response protocols
 - b) Support rapid response
 - c) Control established AIS
 6. **Education:** Increase public awareness of AIS in Long Island Sound through education and outreach
 - a) Facilitate access to AIS resources / information / contacts
 - b) Promote AIS awareness through education and outreach
 7. **Research:** Identify research priorities and potential funding sources for AIS in Long Island Sound
 - a) Promote AIS research
 - b) Identify existing research efforts
 8. **Legislation, Regulation, and Policy:** Strengthen enforcement of existing regulations, revise regulations as needed, and strive for future AIS-related legislation or regulations that are comparable in Connecticut and New York
 - a) Assess and strengthen existing authorities
 9. **Priority Actions:**
 - a) Establish a LIS AIS Coordinating Committee, with designated co-chairs from the States of Connecticut and New York
 - b) Coordinate with Connecticut and New York State ANS Plans, and develop risk assessment, management, and policy procedures
 - c) Establish an annual work plan
 - d) Implement a monitoring program
 - e) Facilitate access to AIS resources / information / contacts
 - f) Seek funding for implementation
 - g) Minimize introductions through marine commerce, marine recreation, education and research, the live seafood trade, and habitat restoration

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SECTION 1. INTRODUCTION

1.1 Scope of the AIS Problem in Long Island Sound

The introduction and spread of aquatic invasive species (AIS) into the marine, estuarine, and brackish habitats of Long Island Sound pose a serious threat to the ecological health and biodiversity of native ecosystems, and can affect the economic interests and public health of the residents of Connecticut and New York. These introduced species have the potential to establish and spread rapidly due to a lack of physical and biological constraints in the habitats to which they have been introduced. The range of impacts these organisms can have on aquatic systems is extensive, including loss or degradation of habitat and community structure, localized or complete extinction of rare and endangered species, spread of pathogens that impact the health of established species, choking of water intakes and wetland systems, and negative effects on commercial and recreational activities. (For the definitions of selected terms and acronyms used in this plan, please refer to the Glossary and Acronyms.)

1.2 Relationship to other AIS / ANS Plans

To prevent the introduction and spread of AIS in Long Island Sound, there must be interstate cooperation and coordination on issues of mutual concern and interest by the States of Connecticut and New York and relevant federal agencies. This coordination will be facilitated by the long-standing federal/bi-state partnership known as the Long Island Sound Study, an U.S. Environmental Protection Agency (EPA)-directed National Estuary Program. Using the Connecticut Aquatic Nuisance Species (ANS) Management Plan and the Final Report of the New York State Invasive Species Task Force for guidance, the LIS AIS Working Group developed a common goal and several key objectives for this plan, and outlined priority tasks and strategies to aid in its implementation. Whether this plan will be an amendment to the current Connecticut ANS plan and the NYS ANS Management Plan (currently in revision) or stand on its own, remains to be determined.

The Connecticut plan was developed using the approved AIS plans of Massachusetts, Maine, and Hawaii for guidance. It addresses both freshwater and marine nuisance species. The State of New York is currently revising its 1994 aquatic nuisance species plan which will be incorporated into a comprehensive invasive species management plan for both aquatic and terrestrial systems. New York is also a partner in the Lake Champlain ANS Management Plan with the State of Vermont, and there is also an Adirondack Park Invasive Plant Program. The Connecticut plan (adopted in 2007) served as the foundation for this plan, the 2005 final report of the New York State Invasive Species Task Force was used as a reference, and the Lake Champlain Basin Program AIS Management Plan provided a model for interstate plan development.

Connecticut and New York are member states of the Northeast ANS (NEANS) Panel, a regional panel of the Federal ANS Task Force, and participate in semi-annual panel meetings to review and discuss priorities for the region, some of which are reflected in this plan. The NEANS Panel is an important mechanism in facilitating interstate coordination. Panel meetings help the Northeast states share ideas, expertise, and resources, discuss concerns and priorities with several neighboring Canadian provinces, and facilitate multi-state collaborations.

1.3 The Development of the LIS AIS Plan (Process and Participants)

The Long Island Sound Interstate Aquatic Invasive Species Working Group (the LIS AIS Working Group) was established in January 2007 to coordinate and enhance efforts for the prevention and management of AIS through the development of this management plan. The Working Group is made up of representatives from state and federal agencies, academic institutions, and industry and community representatives (see Acknowledgments) and has worked to coordinate existing management efforts, identify priority nuisance species to target for prevention and control (wherever possible), and develop specific objectives and actions focused on management, research, and outreach/education. The Working Group was coordinated by a Steering Committee of writers that included a representative from the Connecticut Sea Grant College Program,

University of Connecticut (CTSG), a Ph.D. candidate from the Department of Marine Sciences, University of Connecticut, and a Masters candidate from the Marine Sciences Research Center, Stony Brook University. Funding from the New England Interstate Water Pollution Control Commission through a cooperative agreement with the EPA LISS, Connecticut Sea Grant, and New York Sea Grant facilitated the development of this interstate AIS management plan for Long Island Sound.

Scientific Review Process

Faculty members of several Connecticut and New York colleges and universities served as members of the LIS AIS Working Group, serving in the role of scientific advisors and content reviewers. The draft plan was also provided to members of the LISS Science and Technical Advisory Committee for review and comment.

Public Review Process

During the fall of 2007, the draft plan was made available via the internet, and broadcast by e-mail to various list serves with a request for comments. The LIS AIS Working Group steering committee also made several public presentations on the draft LIS AIS management plan. During each presentation, the plan was outlined briefly and members of the public given an opportunity to speak/ask questions. Written comments were also encouraged. Presentations followed by a question and answer session were made to the NYS Marine Resources Advisory Council (11/13/07; East Setauket NY), the LISS Science and Technical Advisory Committee (11/16/07; Stamford CT), and the LISS Citizens Advisory Committee (12/13/07; Stamford CT). A summary of comments made during the public meetings and the explanations provided in response can be found in Appendix F.

Agency Review Process

Upon completion of the public meetings and drafting of responses to comments received, the draft LIS Interstate AIS Plan will be submitted to the New England Interstate Water Pollution Control Commission (NEIWPC), the EPA LISS Management Committee, the New York State Departments of State (NYS DOS) and Environmental Conservation (NYS DEC), and the Connecticut Department of Environmental Protection (CT DEP). The agencies will conduct their normal internal review process, and discussions will be held through the EPA LISS Management and Policy Committees on the next steps for potential plan adoption and implementation.

SECTION 2. PROBLEM DEFINITION AND RANKING

The challenges posed by aquatic invasive species are the effective management of marine, estuarine, and brackish systems and the increasing need for governmental policy regulating these environments. Since established populations of aquatic introduced species may be self-sustaining, resources are typically devoted to both the prevention of new introductions through known pathways, particularly of those species likely to become invasive, and to the control of new or existing populations of invasive species. In the case of systems like Long Island Sound, control options (which include by definition eradication, suppression, reduction or management of invasive species populations, spread prevention, and habitat and species restoration) are more limited. However, a number of papers presented at the 5th International Conference on Marine Bioinvasions (Cambridge MA, May 2007) described an increasing number of attempts to eradicate invasive species in marine systems, some with apparent success and others where success is yet to be determined.

2.1 History and Biogeography of AIS in Long Island Sound

For the purposes of this management plan, the Long Island Sound estuary is defined by the average summer extent of salt water intrusion, specifically the mesohaline limit (a salinity of 5 ppt), in all freshwater tributaries. It is limited to brackish and marine species, and for simplicity, it excludes species that are addressed specifically by other plans.

Long Island Sound (LIS) is situated between the southern border of Connecticut and the northern shore of Long Island, New York. The Connecticut River watershed and seven other major basins empty into Long Island Sound (LIS). The LIS estuary was one of the first nationally significant estuaries designated by the U.S. Environmental Protection Agency (EPA), and supports a variety of coastal and marine habitats and organisms. About 110 miles long and 21 miles wide at its widest point, LIS has 600 miles of coastline. The Sound is unusual in that it is oriented east to west, while most estuaries orient north to south. Because it is located near the boundary of two biogeographic provinces (the Virginia Province to the south, and the Boreal Province to the north of Cape Cod), both coldwater and warm water estuarine and marine species are supported. Ocean water from the Atlantic enters from the eastern end, while significant fresh water inputs are received from the Thames, Connecticut, Quinnipiac, and Housatonic Rivers in Connecticut. The Sound has a second connection to the ocean, through the East and Hudson Rivers/New York Harbor at the Sound's westernmost point. The overall economic value of Long Island Sound has been estimated to exceed \$8.25 billion per year (Parker 2007).

More than 50 introduced and 40 cryptogenic species have been identified in Long Island Sound (MacLellan 2004; Appendix B, Tables B-1 and B-2). Most of these species are not considered invasive, although their presence has likely resulted in some change to the local ecosystem. Species such as the European green crab (*Carcinus maenas*) and the common periwinkle snail (*Littorina littorea*) were introduced to the Sound more than 150 years ago. Others are more recent introductions, such as the Asian shore crab (*Hemigrapsus sanguineus*) reported in the early 1990s and the red alga (*Grateloupia turuturu*), reported in September 2004.

2.2 Existing and Potential Impacts of AIS in Long Island Sound

In the United States, more than 15% of introduced species cause serious harm; introduced species negatively impact at least 42% of endangered species; and the cost associated with major invasive species is in the billions of dollars annually (Aquatic Nuisance Species (ANS) Task Force website www.anstaskforce.gov/impacts.php). Cornell University studies estimate that annual costs associated with

both terrestrial and aquatic invasions by non-native species exceed \$120 billion (NYSISTF 2005). Fifteen recent introductions could cost the U.S. \$134 billion by 2050 (<http://www.anstaskforce.gov/default.php>).

Impacts from aquatic invasive species can include:

- ◆ Reduced diversity of native flora and fauna due to environmental effects such as increased predation, parasitism, competition and displacement, introduction of new pathogens, changes in genetic make-up, wildlife habitat alterations and degradation
- ◆ Degradation of water quality
- ◆ Economic impacts causing increased costs for services, products, infrastructure, or maintenance among commercial, recreational, and industrial users
- ◆ Increased threats to public health and safety
- ◆ Increased threats to proper functioning and maintenance of power generation utilities; increased costs for maintenance and operation

2.2.1 Economic Impacts

Long Island Sound is a significant U.S. estuary, serving as spawning, nursery, and feeding grounds for many coastal and estuarine species. These species form the basis of important bi-state commercial and recreational fisheries, which in 1992 were calculated to contribute \$150 million and \$1 billion to local economies, respectively (Altobello 1992). As with most estuaries, the Sound is valued for its recreational, commercial, economic, and aesthetic values. It is sometimes referred to as the “Urban Sea”; 8.6 million people live within the Sound’s 16,000-square-mile watershed, and more than 20 million people live within an hour’s drive of the shore (Burg 2006). There are more than 600,000 registered boats in Connecticut and nearly 530,000 registered boats in New York (Molnar 2004; NYS Office of Parks, Marine Services Unit, 2007), although not all are used on Long Island Sound. Creel surveys support estimates of 450,000 marine anglers fishing in Connecticut (Molnar 2004). A catch and effort survey conducted by the National Marine Fisheries Service estimated more than 500,000 anglers made 4.6 million fishing trips in the marine waters of New York in 2004; however, a distinction between trips made within Long Island Sound and other marine waters of New York was not made. The Sound also supports heavy commercial shipping traffic that travels to Connecticut deepwater ports in New London, New Haven, and Bridgeport carrying 18.2 million short tons of waterborne commerce in 2002 (<http://www.cityofnewhaven.com/PortAuthority/index.asp>; accessed 10/17/07), and to the Port of New York and New Jersey, with its seven terminals overseen by the Port Authority of New York and New Jersey, along with numerous privately-operated terminals. According to the Port Authority website (http://www.panynj.gov/DoingBusinessWith/seaport/html/regional_port.html; accessed 10/17/07), more than 25 million tons of ocean borne commerce moves through these New York and New Jersey ports annually.

Impacts on Commercial Fishing / Saltwater Fishing / Boating

AIS alter aquatic habitat, disrupt food chains, and reduce the growth, survival and abundance of native marine species. Both recreational and commercial fishing and their associated economic benefits may be adversely affected. One example is the potential loss of productivity in offshore fishing grounds following the introduction of the non-native tunicate, *Didemnum* sp., which forms large mats over the bottom. Fish diseases can also be introduced, with devastating effects. It is unknown whether the paramoeba, *Neoparamoeba pemiquidensis*—a significant factor in the 1999 die-off of lobsters in LIS—is naturally-occurring or introduced. The Long Island Sound commercial lobster fishery, worth more than \$40 million in the mid-1990s, has yet to recover from this resource disaster.

Many fouling organisms are invasive species, including a number of species of tunicates or sea squirts. These organisms increase the amount of hull fouling, in addition to fouling lines, piers, and docks, increasing maintenance costs and reducing fuel efficiency. Boats with fouled hulls, sea chests and propellers that are moved from one geographic region to another (e.g., between winter and summer ports) increase the risk of new introductions and should be cleaned before the trip. Hull cleaning and

maintenance activities should address the need to keep organisms from being released into local waters in addition to all the considerations for proper disposal of paint scrapings, etc.

Recreational anglers can also inadvertently introduce new organisms to a water body through the use of live bait that escapes or is released. Further, disposal of the seaweed, in which marine worms and crabs are packed, directly into the water raises the threat of introduction of organisms contained in the seaweed.

Impacts on Shellfish and Shellfish Aquaculture Industry

Aquaculture operations, the raising of aquatic organisms under controlled conditions, can be both a pathway by which invasive species are accidentally introduced into an ecosystem, as well as be adversely affected by them. There is potential for release of alien species during aquaculture operations—not only of the species in production, but also any animals, algae, or pathogens that are inadvertently included in shipments of organisms.

Currently, more than 70,000 acres of shellfish grounds are leased in Connecticut waters for the farming of oysters and hard clams, a \$12 million industry in 2003, and there are significant public shellfish grounds on the north shore of Long Island, New York as well as shellfish aquaculture operations in Oyster Bay. In Long Island Sound, commercial harvests of the native Eastern oyster (*Crassostrea virginica*) peaked at more than one million bushels harvested in 1992. By 1997, harvests had declined to about 250,000 bushels due to two parasitic diseases, MSX (*Haplosporidium nelsoni*) and Dermo (*Perkinsus marinus*). These diseases spread through proximity to infected oysters. Ex-vessel income (income that the shellfish growers receive for their product) from oysters decreased from almost \$50 million in 1991 to less than \$10 million in 1997; in 2004, harvests remained below 100,000 bushels, valued at \$5 million (LISS Sound Health 2006). On the north shore of Long Island, NY, the public oyster beds from Huntington Bay to Port Jefferson Harbor produced as many as 40,000 bushels per year alone through 1997 (NYSISTF 2005). The arrival of both MSX and Dermo in the late 1990s reduced the annual oyster harvest to 1,500 to 4,500 bushels per year. The successful breeding of disease-resistant oysters in Connecticut aquaculture facilities and elsewhere may help restore the oyster aquaculture industry in both states.

Toxic or harmful algal blooms (HABs) such as “red tide” can pose health threats to both marine organisms and humans, resulting in fish kills and significant economic losses to shellfish harvesters or shellfish aquaculturists. The plankton species, *Aureococcus anophagefferns*, which causes the “brown tide” that has a deleterious impact on eelgrass beds, commercially-important shellfish, and plankton, has been a member of the phytoplankton community in the Northeastern U.S. at least since the 1980s, and maybe more than 120 years (Dooley 2006). While found in estuarine communities from Maine to Florida, it is still cryptogenic in origin. Its first appearance in Long Island bays in 1985 devastated the bay scallop industry on Long Island. According to the NYS DEC, average yearly scallop harvests in Long Island bays declined from 300,000 pounds valued at \$2 million in 1985 to 6,000 pounds in 2005, worth just over \$150K (www.dec.ny.gov). Recently, a scientific study demonstrated that shellstock has the potential to transport viable algal cells—including those that cause localized HABs—from one area to another (S. Shumway, University of Connecticut, personal communication, 2007).

Bacteria, viruses, and parasites that can cause human illness or infect marine organisms can be transported to Long Island Sound via ballast water. Of particular concern are bacteria of the genus *Vibrio*, which can cause cholera or other severe human illnesses, as well as have significant implications for the health of marine organisms. *Vibrio parahaemolyticus* was found in ballast water of ships entering New York Harbor and introduced *Vibrios* are the suspected source of a food-borne illness outbreak from shellfish harvested from Oyster Bay, NY (NYSISTF 2005).

A number of invasive tunicate species foul aquaculture equipment such as cages and bags, increasing maintenance costs for the industry. The economic impact of these fouling organisms on mariculture operations is currently under investigation (Whitlatch et al. 2005).

European green crabs (*Carcinus maenas*) and Asian shore crabs (*Hemigrapsus sanguineus*) prey on juveniles of commercially valuable shellfish; the green crab has been implicated as the cause of the demise of the soft-shell clam industry in Maine and other parts of the Northeast. Lafferty and Kuris (1996) estimated that potential losses due to green crab predation on commercial fisheries species in the United States could reach \$44 million.

Impacts on Power-Generating Facilities

Water is an important resource for electric-generating utilities, used to cool and condense steam produced by nuclear or fossil-fueled plants, and to drive turbines at hydroelectric facilities. With the introduction of non-native species to freshwater and marine habitats came an increase in maintenance costs to control biofouling and to mitigate water flow blockage in piping and heat exchangers. Biofouling problems affecting ocean-sited power plants are caused by both native and invasive species. Power plants sited along the LIS shoreline are typically designed and built with coarse bar trash racks and finer mesh traveling screens to filter out large detached seaweeds and aquatic plants (e.g., macroalgae and eelgrass), as well as terrestrial debris that washes into the Sound. The organism of greatest concern to facilities using LIS water for cooling is the native blue mussel (*Mytilus edulis*). Larval densities can be very high (especially in spring), and the typical intake trash rack/traveling screen system is too coarse to exclude the settleable plantigrade stage (around 0.5-2.0 mm). Owing to the mussels' resistance to fouling control, any anti-fouling regime that controls them will likely control other native or invasive fouling species of a similar size range that enter the system.

Prevention is preferable to mitigation in biofouling control. The most commonly used biofouling control procedures include thermal backwashes to control macrofouling in condensing cooling water systems, supplemented by intermittent chlorination to control microfouling of the condensers, continuous low-level chlorination of service water systems, and occasional manual cleaning of areas that cannot be otherwise treated. At some facilities, ongoing monitoring programs, conducted as part of the environmental impact assessment for the power plant, are designed to evaluate the effectiveness of the fouling control, and to detect the introduction of new fouling organisms.

Impacts to Infrastructure

Organisms that bore into wooden structures such as piers, bulkheads, and wooden boat hulls can create high maintenance and/ or replacement costs. One species of shipworm, *Teredo navalis*, and a small crustacean known as a gribble, *Limnoria tripunctata*, have invaded marine waters in New York and Connecticut and caused extensive structural damage in New York Harbor (NYSISTF 2005). *T. navalis* is widely distributed around the world.

Another shipworm species, *Teredo bartschi*, has occurred in LIS but only in thermally enhanced areas (D. Morgan, Millstone Environmental Laboratory, email communication, 29 May 2007). Data gathered in the early 1980s by the Millstone Environmental Laboratory (Waterford CT) indicate year-round populations could establish in the Sound if temperatures increased by as little as 2°C. Water temperatures in LIS are approaching temperatures that might be conducive to a geographical range extension of this species. However, most manmade wooden structures in the marine environment are protected from woodborers and this extension is not as costly as it once might have been. Ship worms also forced the transition from wooden traps to those constructed of wire and plastic.

2.2.2 Biodiversity and Ecosystem Impacts

Reduced Diversity of Native Flora and Fauna

Biodiversity is the variety of all living things, from species to habitat communities to ecosystems (NYSISTF 2005). E. O. Wilson stated that "on a global basis...the two great destroyers of biodiversity are, first habitat destruction, and, second, invasion by exotic species" (NYSISTF 2005). Invasions of non-

native species in general can have ecological costs, as ecosystems are pushed towards homogeneity and local, unique diversity is lost (Ruesink 1998). Not only can the number and abundance of native species be reduced, serious threats to any endangered and threatened species present may arise. Introductions of new predators, competitors, diseases, or parasites threaten the structure and biodiversity of local ecosystems (Carlton and Geller 1993). The disturbance results in degradation of the ecosystem function and potential displacement of native species. Many introduced species go unnoticed or are mistaken for native species; later they may be labeled “cryptogenic,” an acknowledgement that their origins are unclear (Carlton and Geller 1993).

One example of a species that dominates both marine and fresh water habitats and reduces biodiversity within an ecosystem is the introduced sub-species of the common reed (*Phragmites australis*) which is very invasive. *Phragmites* is considered by federal and state estuary programs to be one of the preeminent threats to saltmarsh habitat; the percentage of *Phragmites*-dominated areas has grown significantly over the past 3-5 decades. Invasive *Phragmites* grows tall and thick, choking out native vegetation, and providing little in terms of food value or shelter. In both Connecticut and New York, there are ongoing efforts to remove and control its growth in certain areas, including wetland restoration project sites. Connecticut banned the sale of *Phragmites* in 2004, and in 2007, the Suffolk County (NY) Legislature included *Phragmites* on a list of 64 plants that will be banned from sale by wholesalers and retailers by 2011. The invasive strain of *Phragmites* is considered one of the most important AIS in New York State waters.

Purple loosestrife (*Lythrum salicaria*) is also a major invader of brackish and fresh water wetlands. While pretty to look at, like *Phragmites* this plant dominates wetland vegetation and provides little in terms of food value (although its long-lasting blooms make it a popular plant among beekeepers). A biological control plan for purple loosestrife was developed in the mid-1980s using host-specific beetles. Today these beetles are being reared and released into wetlands to feed upon purple loosestrife in 35 states and as a result, infestations of purple loosestrife in many wetlands has been reduced, bringing about the return of invertebrates, amphibians, birds, and mammals to the wetlands. Connecticut banned the sale of purple loosestrife by commercial nurseries, among other plant species, in 2005. The Suffolk County (NY) Legislature included purple loosestrife on a list of 64 plants that will be banned from sale by wholesalers and retailers by 2011. Purple loosestrife is considered one of the most important AIS in New York State waters.

The Asian shore crab (*Hemigrapsus sanguineus*) has displaced native crab species (as well as the European green crab) in the intertidal area and is now the most abundant crab in the rocky intertidal zone in LIS. Since they were reported in LIS in the early 1990s, they have expanded their habitat to at least 90 meters in depth. While there do not appear to be any feasible options for control or eradication of these crabs, they are being consumed by some species of fish and are also used as bait by anglers. These crabs do eat juvenile shellfish of commercial importance; the European green crab and the Asian shore crab also feed upon each other.

The Chinese mitten crab (*Eriocheir sinensis*) is catadromous, living in both freshwater and saltwater habitats. It migrates from freshwater rivers and tributaries to salt water to spawn (SERC 2007). The crabs destabilize stream banks with their extensive burrowing, and can leave the water to walk around obstacles. In June 2007, one live male Chinese mitten crab was captured in the Hudson River near the Tappan Zee Bridge (L. Surprenant, NYS DEC Invasive Species Management Coordinator, email 060807). Other specimens have been identified in live seafood markets in New York and confiscated.

The discovery of extensive mats of the colonial tunicate (*Didemnum sp.*) in eastern Long Island Sound is raising concerns about the species' potential impact on shellfish and other benthic organisms. In one area, the mat covers about a square mile of the seafloor and its associated biota.

2.3 AIS Risk Assessment, Risk Management, and Risk Policy

The purpose of this plan is not to create management actions or policies for a particular species, but rather to create a protocol that will aid in determining which mitigation procedure is best applied to the species of concern. Risk management actions and policy will be specific to each organism, and determined by the risk management protocol. The risk management protocol for a particular species will include an operational pyramid with risk assessment at the base, an overview of current standards, effective mitigation, feasibility at each successive level, and finally, monitoring (Risk Assessment and Management Committee 1996).

It is proposed that the AIS Coordinating Committee consider whether to designate a subcommittee of interested parties to conduct a risk assessment whenever a new species is reported in LIS or whenever there is immediate potential for a new species to invade, i.e. when a species has invaded a similar habitat in close proximity to LIS. This enables the ecological, economic, and sociological risks associated with this organism to be assessed (as outlined in Objective 1.B.2). Once the risk assessment is completed, it is the responsibility of the designated parties to determine the appropriate policy and operational measures.

Determining the appropriate course of action can be done by creating a mitigation matrix (see Appendix D for an example of a mitigation matrix). A mitigation matrix matches the available mitigation options with the identified risks, i.e. organisms or groups of organisms are placed along one axis, and the available mitigation options are placed along the other. Where an organism and a specific mitigation process intersect in the matrix, the efficacy of control is recorded. Efficacy of control may be defined as < 95% (some reduction of pest expected), ≥ 95% (extensive reduction of pest expected), and 100% (total reduction of pest risk expected; as reviewed by ANS Task Force 1996). This process aids in the identification of mitigation(s) needed to reduce the risk of an invasive species to an acceptable level. Such mitigation matrices have been used in mitigation reports on New Zealand log imports (USDA, APHIS 1992) after a New Zealand log risk assessment identified a number of invasive species hitchhiking with *Pinus radiata* and Douglas-fir logs, lumber, and wood chip imports.

Once the most effective mitigation(s) have been identified, it is required that the designated subcommittee considers whether or not the action is feasible. Feasibility is dependent upon available mitigation safeguards, resource limitations, and the perceived damage of the course of action. For example, mitigation safeguards may already be in place or may need to be obtained prior to continuing with a course of action, i.e. prohibition of possession or transport of an organism, acquisition of permits to transplant an organism, or industry standards regarding the concentrations of particular organisms or viruses. Likewise, available resources should be assessed to ensure that there are adequate funding, qualified personnel, time commitments, and necessary information available to undertake the task. Finally, the costs and benefits to the ecosystem and the public should be determined. A cost-benefit analysis is crucial in developing an operational approach that balances resource protection and utilization.

Development of a realistic operational approach is not an easy feat. Each operational decision will reflect a number of management, agency, and biological factors that are unique to a specific invader. Therefore, the issue of review at each risk management level is highly recommended. In addition, a system of monitoring should be established for each operational approach to guarantee that all mitigation requirements are met and that the efficacy of control is not reduced. Monitoring each approach fosters the adaptability of risk management plans, e.g. if monitoring results show a reduced effectiveness of the mitigation action or a reduction in resource utilization, then the mitigation matrix and resource bank might be reassessed to choose the next feasible approach.

2.3.1 Developing Rapid Response and Control Guidelines

A successful invasive species policy should not only prevent new introductions, but control or eradicate newly established populations in an environmentally sound and safe manner. While specific guidelines

will be developed on a case-by-case basis, Bax et al. (2001) provide an iterative framework to solve identified problems with the lowest risk possible in order to control invasive species.

The first step in the framework is to establish the nature and magnitude of the problem (which is equivalent to the outcome of the risk analysis). The designated subcommittee should focus on several key components of the risk analysis outcome, e.g. whether or not the species is indeed an alien rather than a locally rare or seasonal species responding to an altered environment; determination of the vector and if future invasions could occur by this vector; identification of the local and regional distribution of the species and therefore, areas requiring control; and estimates of the actual and potential effects, such as ecological effects, direct economic losses, and impacts on public health. It should be noted that the risk analysis process is time consuming. In order for control to be easiest or even possible, it must occur at earliest stages of an invasion. Therefore, temporal and financial restraints should be placed on the designated subcommittee.

Once the problem has been defined, clear objectives must be set with regard to what the designated subcommittee wants to accomplish, i.e. protect native biodiversity, restore economic benefits, or progress with rapid response to totally eradicate a species. Despite the objectives decided upon, a full range of alternative management options should be considered, including non-control options. These alternatives might include improved fisheries management, pollution remediation, habitat alteration, etc.

As previously stated, the goal of successful invasive species control is to effectively control the problems generated by the species while minimizing the risk of undesired outcomes. Mitigation matrices (see section 2.3) can be used to find the most effective management action, and the designated subcommittee should convene to determine risks associated with each. Once determined, these risks might be reduced by limiting control to the identified pest or a specific area of habitat, while paying special attention to unique habitat or other species of concern in that area. Reducing risk might also include concurrent exploration of additional control methods on an experimental basis, and monitoring results to determine the effectiveness of alternative approaches. If more effective than the chosen method, the experimental approach could be implemented on a full-scale basis.

Rapid response guidelines follow a similar framework but are subject to strict timelines. Therefore, processes such as experimental investigations of alternative approaches are not ideal. Common sense dictates that when discovered, an attempt should be made to contain the invasion as soon as possible while deciding whether total eradication is possible and feasible.

In general, three management actions are employed to control invasive species: chemical, mechanical, and biological. However, chemical and biological control is not always organism-specific and often results in everything being killed or impacts on multiple trophic levels. For example, *Mytilopsis* sp. was eradicated from three locked marinas in Darwin Harbor, Australia using chlorine and copper sulfate, but there was also high non-specific damage (McEnnulty et al. 2001). Likewise, it has been suggested that the West Atlantic butterflyfish could be a useful control agent of the comb jelly (*Mnemiopsis*) in the Black Sea (as reviewed by Bax et al. 2001). While the comb jelly is included in its diet, it does not prey exclusively on ctenophores and other prey species could be affected, resulting in altered trophic cascades. In contrast, mechanical removal specifically targets the organism of concern, whether it be picking of molluscs or torching seaweeds. While this method causes low ecological damage, it is labor-intensive and expensive.

This plan states that Management Classes 1 and 2 (see Section 2.5) with a high or medium rating will be evaluated for rapid response or control. It is suggested that the designated parties refer to Cacho (2006) when trying to determine when it is optimal to switch from eradication to containment. While the model developed by Cacho (2006) says nothing about techniques to be used, it does provide a rapid-assessment decision tool that requires an estimate of only four parameters: area at risk, speed of spread, cost of control, and cost of damage. Because of the difficulty in assessing cost of damage, a discussion of

sensitivity analysis provides managers with a tool to make decisions based on quantitative damage values, rather than qualitative assessments.

2.4 Priority Vectors

A number of inter- and intrastate current and potential pathways/vectors for AIS were identified by the LIS AIS Working Group. A summary of these pathways is provided in Table 1, including potential mechanisms for introduction into and dispersal throughout the Sound and the region. Over time, these vectors and pathways will be addressed on many levels, including regulation/policy, legislation, education, and research. This list will be reviewed and updated periodically by the AIS Coordinating Committee or a designated sub-committee. More information on these pathways is provided (Appendix A).

2.5 Priority Aquatic Invasive Species

A list of marine introduced species in Long Island Sound compiled by MacLellan (2004) was revised and updated, along with a table of disease organisms and pathogens (Appendix B, Tables B-1 and B-2). Three sites along the Connecticut coast (Mystic, Milford, and Stamford, Connecticut) and two on eastern Long Island (South Jamesport and Greenport, New York) were included in a rapid assessment of marine AIS conducted in southern New England waters (Pederson et al. 2005). The results can be viewed at <http://chartis.mit.edu/website/invasives/viewer.htm>. From these assessments, one additional cryptogenic species, the Cnidarian (*Laomedea calceolifera*) was added to the list.

Priorities for Action by Management Class

A number of introduced species from these lists were prioritized for management action, since not all species deserve or can have the same management priority given the resources available. Decisions were made to prioritize the species for management, research, and outreach/education attention. In addition to categorizing AIS already established in Long Island Sound, the LIS AIS Working Group also considered species that have the potential to survive and become established if introduced. These species will largely be addressed through introduction prevention measures and educational programs.

Marine invasive species were categorized into management classes (Table 2) to facilitate the prioritization of management efforts and to further focus research and outreach activities. The LIS AIS Working Group revised the order of the management classes used in the Connecticut ANS Management Plan, putting more emphasis on those for which there is more potential for management action in marine systems.

These management classes categorize species according to the extent of the invasion and the degree by which current management capabilities can effectively control them and/or prevent further spread (Tables 3a and 3b). It is expected that the management class listings will be updated annually by the behest of the AIS Coordinating Committee or a designated sub-committee.

The Generic Nonindigenous Aquatic Organism Risk Analysis procedure (Risk Assessment and Management Committee 1996) developed for the ANS Task Force was used to evaluate potential risk from recently reported invasive species in LIS as well as species that have the potential to be introduced and become invasive in the near future (Table 3; Appendix C). The life history and characteristics of these species indicate that there is likelihood that they could survive in the Sound's current climate, or could become established if there was a subtle change in the environment or climate over time that favored them (e.g. localized and sustained warming trend). Previously-established species that have not demonstrated invasive characteristics are unlisted. The list of marine species will be updated periodically as new information becomes available or new species are reported in the region.

Table 1. Potential Mechanisms for Introduction and Dispersal Within Long Island Sound		
Mechanism Category	Examples	Introduction (I) and/or Dispersal (D)
Natural Dispersal (passive and active)	Wind, currents, water fowl, migratory fish	I, D
Transportation	Hulls, sea chests, propellers, niche areas on commercial vessels and recreational boats (fouling organisms)	I, D
	Ballast water and sediments (planktonic organisms and larvae, adult organisms)	I, D
	Hull cleaning activities (organisms removed from boat hulls and washed into water)	I
Equipment	Dredging equipment	I, D
	Dive and snorkeling gear; sampling gear, nets, traps	I, D
Organism Handlers	Bait trade/anglers (release of bait worms, seaweed packing material, and associated "stowaways")	I, D
	Aquaculture (target or non-target organisms, pathogens, harmful algal blooms (HABs))	I
	Seafood industry/retailers/restaurants/(live seafood trade)	I
	Seafood consumers (cultural incentives)	I, D
	Aquarium industry/hobbyists (intentional or accidental releases of target or non-target organisms; pathogens)	I
	Research facilities (target or non-target organisms; pathogens)	I, D

Effective management of AIS includes elements of prevention, monitoring for early detection, rapid response, and control. The need for and relative importance of these elements varies among different AIS species, vectors, and habitats. Success in effectively managing AIS depends on our technical knowledge, the selection of appropriate priorities for action and, ultimately, our ability to garner the resources necessary to implement these actions.

For Long Island Sound, the primary objectives are to use education, regulation, and policy to prevent the introduction and spread of AIS, monitoring for early detection of new introductions and routine checks of existing populations, and control, where feasible. There are an increasing number of case studies where eradication of an invasive species in marine waters has been attempted, and while the "jury" is still out on some of these efforts, others have been deemed successfully eradicated (Anderson 2007; Chang and Ruiz 2007; Gould et al. 2007; Montgomery 2007; Weiskel et al. 2007). Nonetheless, control in marine systems is very difficult and the best defense against new invasive species is to interrupt the pathways or vectors by which they are transported and prevent new introductions through education, regulation, or policy. Established monitoring sites in various basins of the Sound will aid in the detection of new species and populations, and will help assess changes in existing populations of alien or invasive species.

Table 2. Management Classes for Invasive Species and Priority Management Actions

Management Class	Description	Priority Management Actions
Class 1: Potential AIS Invaders, Impacts Expected to be Severe	<i>Includes species not yet reported in Long Island Sound waters that have a high likelihood of introduction, and if introduced, are expected to have significant biological and/or socio-economic impact.</i>	<ul style="list-style-type: none"> • Prevention of introduction to Long Island Sound by addressing pathways • Continued education of citizens focused on preventing introductions, specific to class 1 organisms as well as in general • Systematic monitoring and well-established, well-advertised reporting system for new sightings • Issuance of alerts and educational materials to facilitate early detection and reporting
Class 2: Newly Identified Species	<i>Includes species that have limited or incipient populations within Long Island Sound.</i>	<ul style="list-style-type: none"> • Prevention of further introductions of new populations by addressing pathways • Issuance of alerts and educational materials to facilitate detection of new infestations or to warn residents of danger (e.g., seasonal appearances of lionfish, man o'war) • Systematic monitoring to detect additional populations • Interruption of possible "export" pathways from Long Island Sound • Employ control strategies as feasible
Class 3: Established Species, Significant Impact, Some Practical Control Techniques Available	<i>Includes species present and established in Long Island Sound with known impacts (or potential for impact) that may be mitigated or controlled with appropriate management techniques.</i>	<ul style="list-style-type: none"> • Prevention of further introductions and dispersal to new waters, including interrupting possible "export" pathways from Long Island Sound • Employ control strategies as feasible, to prevent spread of existing populations to unaffected areas and to mitigate impacts (including to rare, threatened or endangered species)
Class 4: Established Species, Significant Impact, No Known Effective or Practical Control Techniques Available	<i>Includes species established in Long Island Sound, with known impacts (or potential for impact), but with no known available effective or appropriately effective management techniques.</i>	<ul style="list-style-type: none"> • Prevention of further introductions of new populations by addressing pathways • Interruption of possible "export" pathways from Long Island Sound
Class 5: Established Species, Impacts Unclear	<i>Includes species that are established in the waters of Long Island Sound and may have the potential to cause impacts, but current knowledge is insufficient to determine what impacts may be.</i>	<ul style="list-style-type: none"> • Prevention of further introductions, including interruption of possible "export" pathways. • Further research to evaluate invasive potential and ecosystem effects • Continued monitoring of existing populations to determine rate of spread

Table 3a. Priority Newly-Identified and Potentially Threatening Marine ANS

Includes most likely transport vectors and current threat level (HIGH = unacceptable risk or organism of major concern, MEDIUM = unacceptable risk or organism of moderate concern, LOW = acceptable risk or organism of little concern). By these standards, mitigation is justified only for those elements receiving medium or high ratings. *See Table 1 for more detailed information/listing of vectors. Management class is also listed below for each species. It is a priority to prevent new introductions. For this reason, all potential invaders are listed under Management Class 1 (potential invaders, impacts expected to be severe). TBD = no formal risk assessment conducted as part of this plan development.

SPECIES	LATIN NAME	VECTORS	PROBABILITY OF ESTABLISHMENT	CONSEQUENCE OF ORGANISM ESTABLISHMENT	ORGANISM RISK POTENTIAL (OVERALL IMPACT)	MANAGEMENT CLASS
Marine Vertebrates						
Lionfish	<i>Pterois volitans/miles</i> <i>Pterois volitans</i> <i>Pterois miles</i>	Wind, currents	M – seasonal/vagrant	L	M	2
Marine Invertebrates						
Man O'War	<i>Physalia physalis</i>	Wind, currents	Seasonal/vagrant	TBD	TBD	2
European flat oyster	<i>Ostrea edulis</i>	aquaculture, wind/currents, seafood industry / retailers / restaurants, hull fouling, ballast water	H (RI waters, 2002)	TBD	TBD	2
Suminoe Oyster	<i>Crassostrea ariakensis</i>	Wind / currents, hull fouling, hull cleaning, aquaculture, seafood industry / retailers / restaurants	M	H	H	1
Veined Rapa whelk	<i>Rapana venosa</i>	Hull fouling, ballast water, seafood industry / retailers / restaurants	H	H	H	1
Chinese Mitten Crab	<i>Eriocheir sinensis</i>	Aquaculture, seafood industry	H	H	H	1* *Live specimens have been found in Hudson River
Grapsid crab	<i>Hemigrapsus penncillatus</i>	Ballast water, wind/currents, bait trade / anglers	H	H	H	1
Asian Sea squirt	<i>Styela plicata</i>	Wind / currents, hull fouling, hull cleaning, ballast water	M	H	H	1

Marine Algae						
Green Alga, Killer Green Algae	<i>Caulerpa taxifolia</i>	Aquarium industry / hobbyists, hull cleaning, ballast water	H	H	H	1
Wakame (invasive kelp)	<i>Undaria pinnatifida</i>	hull cleaning, ballast water	H	H	H	1
Asian rockweed	<i>Sargassum muticum</i>	hull cleaning, ballast water, bait industry	H	H	H	1
Pathogens						
Vibrios	<i>Vibrio cholera</i>	Ballast water	TBD	TBD	TBD	1
Aquatic Vegetation						
Eurasian watermilfoil	<i>Myriophyllum spicatum</i>	Rec. boats, aquarium industry / hobbyists	H*	TBD	TBD	2

*documented in Lower CT River (J. Barrett, personal communication, 2007); salinity tolerance to 15ppt

Table 3b. Priority Established Marine ANS

Includes most likely transport vectors and management class. The organisms in this table have established populations in Long Island Sound. These organisms represent a challenging group to manage effectively because the majority of these species may have known impacts (or potential for impact) with no known available effective or appropriately effective management techniques (Class 4); or these species may have the potential to cause impacts, but current knowledge is insufficient to determine what these impacts may be (Class 5). According to Invasion Meltdown Theory, the possibility exists that future invasions could trigger destructive traits in any one of these species. Risk assessments of future / potential invasive species should investigate possible interactions with species listed in this table. *See Table 1 for more detailed information/listing of vectors.

SPECIES	LATIN NAME	VECTORS	FIRST ESTABLISHED	MANAGEMENT CLASS	ORGANISM RISK POTENTIAL (OVERALL IMPACT)
Birds					
Mute Swan	<i>Cygnus olor</i>	Intentional introduction as decorative waterfowl	1920	3	No formal risk assessment*
Marine Invertebrates					
Green Crab	<i>Carcinus maenas</i>	Hull fouling	1817	4	No formal risk assessment
Asian shore crab	<i>Hemigrapsus sanguineus</i>	Ballast water	1994	4	H
Tunicate	<i>Didemnum sp.</i>	Hull fouling, hull cleaning, ballast water, seafood industry, research facilities	2000s	4	H
Clubbed Tunicate	<i>Styela clava</i>	Wind/currents, hull fouling, hull cleaning, ballast water	1982	4	No formal risk assessment
Rough Sea Squirt	<i>Styela canopus</i>	Wind/currents, hull fouling, hull cleaning, ballast water	1852	4	No formal risk assessment
Compound Sea Squirt	<i>Diplosoma listerianum</i>	Wind/currents, hull fouling, hull cleaning, ballast water	1990	4	No formal risk assessment

Sea squirt	<i>Ascidella aspersa</i>	Wind/currents, hull fouling, hull cleaning, ballast water	1985	4	No formal risk assessment
Orange or red-sheathed tunicate	<i>Botrylloides violaceus</i>	Wind/currents, hull fouling, hull cleaning, ballast water	1980s	4	No formal risk assessment
Golden-Star Tunicate	<i>Botryllus schlosseri</i>	Wind/currents, hull fouling, hull cleaning, ballast water	1871	4	No formal risk assessment
Kelp Bryozoan	<i>Membranipora membranacea</i>	Hull fouling, hull cleaning, ballast water	1990	4	No formal risk assessment
Marine Algae					
Red Alga	<i>Grateloupia turuturu</i>	Wind/currents, hull fouling, hull cleaning, ballast water, shellfish	2004	4	H
Red alga	<i>Porphyra yezoensis</i>	Wind/currents, hull fouling, hull cleaning, ballast water, shellfish	2000s	5	No formal risk assessment
Red alga	<i>Porphyra katadaii</i>	Wind/currents, hull fouling, hull cleaning, ballast water, shellfish	2000s	5	No formal risk assessment
Red alga	<i>Porphyra suborbiculata</i>	Wind/currents, hull fouling, hull cleaning, ballast water, shellfish	2000s	5	No formal risk assessment
Green Fleece	<i>Codium fragile tomentosoides</i>	Hull fouling	1957	4	No formal risk assessment
Brackish and Wetland Vegetation					
Common reed	<i>Phragmites australis</i> (invasive sub-species)	wind /currents, hull fouling, transportation corridors	~1900	3	H**
Purple loosestrife	<i>Lythrum salicaria</i>	Wind/currents, hull fouling, ballast water, gardeners, beekeepers, wildlife	1814	3	H**

* See Atlantic Flyway Mute Swan Management Plan, 2003-2013. Atlantic Flyway Council. 2003. 35pp.

**Purple loosestrife and common reed (invasive strain) both banned by the Connecticut Invasive Plants Council and listed as two of most important invasive species by State of New York.

The Working Group has identified one primary goal, eight key objectives, and a series of associated strategies and tasks for each (see Sections 4 and 5). The Implementation Table (Section 6) outlines the general timeframe and resources that have been identified to date. From this comprehensive set, seven action items were selected as our priorities for action.

Recognition of the management constraints, coupled with the resource limitations that currently exist, has guided the prioritization of the management goals in this Long Island Sound Interstate AIS management plan. The priorities for action listed below will be addressed using a combination of management, education, research, and legislation. Additional information on how and by whom they will be addressed initially is provided in the Implementation Table. In some cases, individual tasks and strategies that have been outlined as important steps towards meeting these priorities have no time or funds associated with them in the Implementation Table (and are listed as TBD or 'to be determined'). Effort is underway to identify appropriate funding sources to facilitate the activities described.

The following priorities for action have been selected:

- a) Establish a LIS AIS Coordinating Committee, with designated co-chairs from the States of Connecticut and New York
- b) Coordinate with Connecticut and New York State ANS Plans, and develop risk assessment, management, and policy procedures
- c) Establish an annual work plan
- d) Implement a monitoring program
- e) Facilitate access to AIS resources / information / contacts
- f) Seek funding for implementation
- g) Minimize introductions through marine commerce, marine recreation, education and research, the live seafood trade, and habitat restoration

SECTION 3. EXISTING AUTHORITIES AND PROGRAMS

Relevant programs that currently address the AIS problem at the state, regional, and federal level are described briefly in the following paragraphs with emphasis on those that have been active in Connecticut and New York, and are necessary to facilitate the implementation of this plan. (The text pertaining to international and federal authorities was largely drawn from the Massachusetts ANS plan.) Where possible, the LIS AIS Working Group has developed management actions based on expansion of the capabilities of these existing programs, particularly at the state and regional level. A table of relevant laws and regulations can be found in Appendix E.

3.1 International Authorities and Programs

While international organizations have limited authority in the United States and countries worldwide, organizations such as the International Maritime Organization (below) have taken a lead role in developing policies and guidelines relating to international trade and commerce. Clearly, invasive species management is an international issue, and limiting uncontrolled global transport of AIS will require some reliance on these agencies to shape and implement management strategies.

Global Invasive Species Program (GISP)

The GISP was established in 1997 to address global threats caused by invasive introduced species, and to provide support to the implementation of Article 8(h) of the Convention on Biological Diversity. GISP looks for innovative ways of improving cooperation with existing and new partners in the invasive alien species world, with the aims of minimizing, and where possible, eliminating any form of duplication while maximizing the effectiveness of joint programs, and promoting the sharing of best-practice information. As an enabling body focused on effective information exchange and networking mechanisms, GISP is one of several significant international efforts assessing the challenges associated with invasive species and developing policies and guidelines (see <http://www.gisp.org>).

International Council for the Exploration of the Sea (ICES)

This organization coordinates and promotes marine research in the North Atlantic. Advice developed by ICES is used by its 19 member nations to help manage the North Atlantic and adjacent seas. ICES has a strong interest in biological invasions and has a Working Group on Introductions and Transfers of Marine Organisms and a Study Group on Ballast and Other Ship Vectors. The working group deals with intentional introductions (e.g., for aquaculture purposes), and, through a risk assessment process and quarantine recommendations, works towards the reduction of unintentional introductions of invasive and deleterious species. The study group focuses on unintentional species introductions from ballast water and hull fouling of ships. The ICES Code of Practice on the Introductions and Transfers of Marine Organisms 2003 recommends procedures and practices to reduce the risk of detrimental effects from the intentional introduction and transfer of marine and brackish water organisms. The Code applies to both public (commercial and government) and private (including scientific) interests (see: <http://www.ices.dk>).

The International Maritime Organization (IMO)

The IMO was established in 1948 to address safety and pollution mitigation measures for the international shipping industry. The United States plays a leadership role on the Marine Environment Protection Committee (MEPC), which is comprised of all 161 Member States, 37 Intergovernmental Organizations, and 61 Non-Governmental Organizations. The MEPC is empowered to consider any matter within the scope of the IMO that is concerned with prevention and control of pollution from ships, including ballast water management and the transport of ANS. IMO Assembly Resolution A.868 (2) was adopted in 1993

and established international guidelines for the control of ballast water, which served as a model for ballast water management in many countries. In February 2004, a diplomatic conference approved a convention on ballast water management. When formally approved by a sufficient number of countries (with a sufficient amount of the world's shipping tonnage), the Convention will become international law.

United Nations – Food and Agricultural Organization (FAO)

The United Nations FAO oversees the International Portal on Food Safety, Animal and Plant Health, which facilitates trade in food and agriculture products and provides a single access point for authorized official and national information across sectors of food safety, animal and plant health. Invasive species are covered under this program, which includes contributing to the implementation of the Convention on Biological Diversity. This is one of several significant international efforts to assess the challenges associated with invasive species and develop policies and guidelines.

3.2 Federal Authorities and Programs

At the federal level, no single agency has authority over the management of AIS. Rather, multiple agencies have developed invasive species programs, largely in reaction to severe AIS issues. Effective invasive species management in the United States will require federal agencies to expand their existing efforts to deter nonindigenous species introductions. These efforts should include better oversight of 1) international and interstate trade and commerce, 2) associated transport vectors such as commercial shipping, and 3) the trade of organisms via mail order and the internet.

NANPCA

The federal government responded to the devastating economic and ecological impacts of the zebra mussel introduction to the Great Lakes by passing the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA, PL 101-646). This act (reauthorized and amended as the National Invasive Species Act of 1996) includes a provision for the preparation of State ANS Management Plans (NANPCA, Section 1204) and outlines the following objectives (Section 1002):

- 1) To prevent further unintentional introductions of nonindigenous aquatic species.
- 2) To coordinate federally funded research, control efforts and information dissemination.
- 3) To develop and carry out environmentally sound control methods to prevent, monitor, and control unintentional introductions.
- 4) To understand and minimize ecological damage.
- 5) To establish a program of research and technology development to assist state governments.

Section 1201 of NANPCA establishes the Federal interagency ANS Task Force (ANSTF). The ANS Task Force is charged with coordinating federal aquatic nuisance species management efforts with the efforts of the private sector and other North American interests. The ANS Task Force is responsible for initiating research programs, planning initiatives, and policy direction for the prevention, detection and monitoring, and control of aquatic nuisance species, and operates through regional panels as well as issue-specific working groups that address particularly problematic invaders.

An additional element of NANPCA is the establishment of ballast management regulations. Under Section 1101 of the Act, the U.S. Secretary of Transportation is charged with developing mandatory ballast water guidelines for the Great Lakes (and later for the upper Hudson River). This task was delegated to and completed by the U.S. Coast Guard, the lead federal agency for ballast water management issues. Amendments to NANPCA in 1996 directed the Secretary to extend ballast water management regulations to the remainder of U.S. waters. Developed and implemented by the Coast Guard in July of 1999, the Voluntary National Guidelines applied to waters outside of the Great Lakes Ecosystem. This voluntary program consisted of a suite of ballast water management (BWM) guidelines, and included a requirement that all vessels entering U.S. waters from outside the Exclusive Economic Zone file a BWM report. A third Coast

Guard related element of the 1996 amendments was the publication of voluntary guidelines aimed at controlling the spread of ANS through recreational activities (i.e., boating, fishing, SCUBA diving, etc.) The Coast Guard worked with the ANS Task Force to complete these guidelines in December of 2000.

In 2004, the voluntary ballast water (BW) exchange and reporting program became mandatory (Federal Register 2004a, 2004b). All vessels with ballast tanks on all waters of the U.S., regardless of Exclusive Economic Zone (EEZ) entry have mandatory practices they must follow, which regulate where ballast operations can take place, mandate cleaning and maintenance protocols, and require vessel-specific BW management plans (USCG 2004). In addition, all vessels transiting to U.S. waters with ballast water taken on within 200 nautical miles of any coast after operating beyond the U.S. EEZ must conduct mid-water BW exchange prior to entering U.S. waters, retain the BW on board while in U.S. waters, or use a USCG-approved alternative method for treating BW (USCG 2004). There are specific reporting and recordkeeping requirements for all vessels, with penalties for non-compliance (USCG 2004). The specifics of the USCG's BW Management Program are found at <http://www.uscg.mil/hq/g-m/mso/bwm.htm>. All submitted ballast reports are housed within the National Ballast Information Clearinghouse (NBIC) at: <http://invasions.si.edu/nbic/index.html>.

On March 30, 2005, the U.S. District Court for the Northern District of California ruled in Northwest Environmental Advocates (NWEA) et al. v. EPA et al. that ballast water often contains invasive species that can be considered pollutants under the Clean Water Act (CWA). The court also held that EPA exceeded its CWA authority in exempting an entire category of discharges from the National Pollutant Discharge Elimination System (NPDES) permitting program (Water Policy Report via InsideEPA.com, 10/31/05; 14(22)). On September 18, 2006, the District Court vacated the regulatory exclusions as of September 30, 2008, giving the EPA two years to comply (EPA 2007; http://www.epa.gov/owow/invasive_species/ballast_water.html). In November 2006, the EPA appealed the ruling; this appeal is currently pending. In the meantime, the EPA issued a request for comments and information on the development of a proposed rule for the regulation of discharges incidental to the operation of a vessel (EPA 2007; EPA Docket ID No. EPA-HQ-OW-2007-0483, published 72 Fed. Reg. 34241-49 062107). The NYS DEC submitted comments on the proposed rulemaking in August 2007 (http://www.dec.ny.gov/docs/administration_pdf/commentsballastwaterrule.pdf).

Federal programs dealing with nonindigenous species that existed prior to the passage of NANPCA are largely related to interstate and international transport of known pest flora and fauna and the protection of valuable horticultural, aquacultural, or endangered species. These laws include:

- **The Lacey Act of 1900 (and amendments):** The Lacey Act establishes a permitting process administered by the U.S. Fish and Wildlife Service regulating the importation and interstate transport of vertebrates, mollusks, and crustacea that are "injurious to human beings, to the interests of agriculture, horticulture, forestry, or to wildlife or the wildlife resources of the United States." The Secretary of the Interior maintains the Injurious Species List.
- **The Federal Seed Act of 1939 (and amendments):** This act prohibits the importation of seeds of unknown type and origin by ensuring the purity and proper labeling of seed imports.
- **The Endangered Species Act of 1973 (and amendments):** The Endangered Species Act can be used to authorize the eradication or control of AIS in the case that a listed species is threatened by the invader's presence or spread.
- **The Plant Protection Act of 2000 (superseded the Noxious Weed Act of 1974):** The Plant Protection Act gives the U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) the authority to prohibit the importation and interstate transportation of species included on the Noxious Weed List developed by the USDA. In cooperation with state agricultural departments, APHIS annually designates priority agricultural pest species for annual intensive monitoring efforts.
- **The Animal Health Protection Act:** Enables USDA APHIS to conduct programs to protect livestock, including "farmed" aquatic animals, against pests and diseases.

The most recent invasive species initiative developed at the federal level came in February of 1999 with Executive Order 13112. This order establishes the National Invasive Species Council, a federal interagency organization charged with the biennial development of a National Invasive Species Management Plan.

Federal Programs and Activities

In addition to the regulations outlined in the above legislation, several government agencies have recognized the severity of the invasive species problem and have adopted the management and control of invasive species as priority program areas.

Aquatic Nuisance Species Task Force

This intergovernmental organization is dedicated to preventing and controlling aquatic nuisance species, and implementing the Nonindigenous Aquatic Nuisance Species Prevention and Control Act of 1990, the mandates of which were expanded with the passage of the National Invasive Species Act (NISA) in 1996. The Task Force is co-chaired by the U.S. Fish and Wildlife Service and the National Oceanic and Atmospheric Administration. It coordinates governmental efforts dealing with ANS in the United States with those of the private sector and other North American interests, through regional panels and issue specific committees. Ten federal agency representatives and 12 ex officio members comprise the Task Force. Among its responsibilities, the Task Force reviews state management plans to address aquatic nuisance species and helps facilitate access to federal funds for implementation of these plans, once approved.

The ANSTF has also created species-specific national management plans for a number of species including the European green crab (*Carcinus maenas*), the Chinese mitten crab (*Eriocheir sinensis*), and the green alga (*Caulerpa taxifolia*), as well as a protocol for researchers investigating aquatic invasive species, and the Generic Nonindigenous Aquatic Organisms (GNAO) Risk Analysis Review Process (Risk Assessment and Management Committee, 1996).

U.S. Department of Agriculture (USDA)

The U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) Plant Protection and Quarantine (PPQ) program manages the Cooperative Agricultural Pest Survey (CAPS). Through the CAPS Program, surveys are conducted to detect or delimit exotic plant pests: insects, terrestrial and aquatic weeds, and diseases that are not known to occur in the U.S. or have been recently introduced through U.S. ports of entry or other pathways. CAPS surveys and other monitoring activities strive to protect agriculture and natural resources and to prevent economic losses. Individual state monitoring programs are directed by a state survey committee, which is made up of representatives from state agencies and scientific institutions. The state survey committee reviews an APHIS-recommended list of potential pests (the Noxious Weed List), and chooses one or more for annual surveillance efforts. Target species may include weeds, plant diseases, insects, and other invertebrates. The CAPS state survey committee serves as an advisory group for CAPS survey activities in the state. Committee members meet several times per year to provide input on upcoming exotic pest surveys, discuss survey results and share relevant information on pest occurrences. Pest distribution data from surveys and other sources provided by state survey committee members is submitted to a national database.

Under the Plant Protection Act and the Animal Health Protection Act, APHIS sets policy and provides scientific support regarding the prevention of intentional or unintentional introductions. APHIS cooperates with the US Department of Homeland Security, Customs and Border Protection Agency, to inspect agricultural products arriving at US ports of entry, although it is estimated that less than 2% of incoming cargo is inspected. With actual responsibility for agricultural port inspection activities being transferred from APHIS to Customs and Border Protection, concerns have been raised about priorities for detecting weapons and illegal drugs versus detecting agricultural pests.

U.S. Coast Guard

The Coast Guard is working to reduce the number of incidental introductions of AIS during the normal operations of ships through the implementation and enforcement of the USCG Ballast Water Management Program (<<http://www.uscg.mil/hq/g-m/mso/bwm.htm>>; see NANPCA above). The Coast Guard also funds the National Ballast Information Clearinghouse, which is housed and maintained by the Smithsonian Environmental Research Center (<http://invasions.si.edu/nbic/search.html>). The Coast Guard's ballast water discharge standard is currently making its way through the regulatory process. In addition, through its research and development centers, the Coast Guard is conducting research relevant to ballast water exchange and ballast water treatments.

National Ballast Water Information Clearinghouse

This is the repository for ballast water reports <<http://invasions.si.edu/nbic/index.html>>. The database is linked to the Smithsonian's Marine Invasions Research Lab. The website includes three ways to submit ballast water management reports, a way to search ballast reports, and other program information. Each year, the results of the ballast water reporting program are vetted and released to the public in a congressional report.

U.S. Environmental Protection Agency, Long Island Sound National Estuary Program

The EPA Long Island Sound Office was established to support the Long Island Sound Study (LISS), a National Estuary Program focused on protecting and restoring the health of the Sound, and to implement the LISS Comprehensive Conservation and Management Plan (CCMP). Developed and approved by the States of Connecticut and New York and the EPA, the CCMP identifies specific commitments and recommendations for actions to improve water quality, protect habitat and living resources, and educate and involve the public. One issue highlighted by the CCMP is the negative effect that introduced species have had by preying upon or competing with sensitive species in this region. A goal of the LISS is to implement management actions that will enhance prospects for a healthy ecosystem with balanced and diverse populations of indigenous flora and fauna. The LISS administers grants that can be used for invasive species education and research. The 2003 Long Island Sound Agreement, which builds upon the goals of the CCMP, called for the LISS to develop a list of the non-native species in Long Island Sound (Appendix B, Table B-1).

U.S. Fish and Wildlife Service (USFWS)

The USFWS has traditionally been the lead in dealing with invasive species at the federal level and is co-chair of the Federal ANS Task Force, providing technical assistance to states in developing invasive species control plans. The USFWS employs an invasive species coordinator in each of its seven regions, one of which represents the Northeast Region and is located at the Lower Great Lakes Fishery Resources Office in Amherst NY. The coordinator networks with local, regional, and national programs, coordinates early detection and monitoring efforts, and contributes to education/outreach activities. A national public awareness campaign directed at recreational boaters and fishermen, Stop the Aquatic Hitchhikers!, is administered by the USFWS. The USFWS has been active in ANS management activities in Massachusetts and Connecticut through the Silvio O. Conte National Wildlife Refuge Invasive Plant Control Initiative. In addition to these activities, the USFWS administers grants that can be used for invasive species management.

U.S. Geological Survey (USGS)

The role of the USGS in nonindigenous species management is to develop new strategies for the prevention, early detection, and prompt eradication of new invaders. The USGS maintains information management and documentation of invasions as one of its priorities. In keeping with this objective, the USGS maintains an

extensive, spatially referenced database of nonindigenous species, which is accessible via the Internet (<http://nas.er.usgs.gov/>).

National Invasive Species Council

Established in 1999, the Council is an inter-departmental council that helps to coordinate and ensure complementary, cost-efficient and effective federal activities regarding invasive species. The Council Co-Chairs are the Secretaries of Agriculture, Commerce, and the Interior. The Secretaries of State, Defense, Homeland Security, Treasury, Transportation, Health and Human Services, and the administrators of the Environmental Protection Agency, U.S. Agency for International Development, U.S. Trade Representative, and the National Aeronautics and Space Administration are also members of the Council. The Council works with the Invasive Species Advisory Committee (ISAC), which was established to advise the federal government on the issue of invasive species and to act as representatives of the many stakeholders. Stakeholders represent states organizations, industry, conservation groups, scientists, academia, and other interests. ISAC has been instrumental in writing the National Invasive Species Council Management Plan (see <http://www.invasivespecies.gov>).

National Oceanic and Atmospheric Administration (NOAA), Department of Commerce

The National Oceanic and Atmospheric Administration (NOAA) serves as a co-chair of the federal ANSTF, along with the USFWS. NOAA, the USFWS and the Maritime Administration of the U.S. Department of Transportation have jointly sponsored research into the development of new technologies for ballast water treatment.

NOAA National Ocean Service, National Estuarine Research Reserves, National Marine Sanctuaries

The NOAA National Ocean Service (NOS) has sponsored survey work for baseline data in marine and coastal areas. In addition to general survey work, NOAA's National Estuarine Research Reserves (NERRs) and National Marine Sanctuaries have participated. NOS has also set up a comprehensive list of taxonomists to help with identification of unfamiliar species in marine and estuarine areas covering everything from protists through fish, and has sponsored integrated assessments of particular species (e.g., lionfish, tunicates).

NOAA Sea Grant

NOAA Sea Grant or the National Sea Grant College Program was established in 1966 to foster research, outreach, and education for the promotion of sustainable development of coastal regions. It operates as a federal partnership with state universities in all coastal and Great Lake states (see Connecticut and New York Sea Grant under Section 3.5 Universities). Sea Grant has played an active national role in supporting research on invasive species issues in the United States; information on these projects can be found at www.sgnis.org. The Sea Grant network has assumed the primary role for national extension and education about aquatic invasive species in collaboration with many partners through projects such as the National Aquatic Nuisance Species Clearinghouse, the National Zebra Mussel Training Initiative, sponsorship of many conferences and workshops, participation in national public awareness campaigns such as the USFWS / NOAA Sea Grant / Pet Industry Joint Advisory Council's Habitattitude™. Educational materials are located at www.seagrant.umn.edu/education/ais_guide.pdf

3.3 Regional Authorities and Programs

New England Interstate Water Pollution Control Commission

Since 1947, the New England Interstate Water Pollution Control Commission has been a leader in the fight for clean water. As a not-for-profit interstate agency, NEIWPCC serves and assists its member states—Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont—

by coordinating activities and forums that encourage cooperation among the states, educating the public about key water quality issues, supporting research projects, training environmental professionals, and providing overall leadership in water management and protection. NEIWPCC's initial emphasis was on surface water protection, but that role has expanded to include wetlands restoration, nonpoint source pollution, water allocation, and underground storage tanks.

NEIWPCC is overseen by 35 Commissioners--five from each member state--who are appointed by their state governors or assume the post due to their position. The Commissioners represent state water pollution control agencies, environmental protection agencies, health departments, industry, municipalities, and the general public. The chairmanship of the Commission rotates between states every two years.

As a partner of the Long Island Sound Study (LISS), NEIWPCC staff play a critical role in the implementation of the LISS 1994 Comprehensive Conservation and Management Plan (CCMP) and its Public Information and Education Program in particular. In support of this program, NEIWPCC produces numerous outreach and educational products, including *Sound Health* and the *LISS Biennial Report*. NEIWPCC also manages the LISS CCMP Enhancement Grants Program. This annual competitive grant program funds priority projects that further the effort to achieve the goals established in the 1994 CCMP, including the grant that supported the development of this plan.

Northeast Regional Panel of the Federal Aquatic Nuisance Species Task Force

Section 1203 of the National Aquatic Nuisance Prevention and Control Act of 1990 directs the Federal ANS Task Force (ANSTF) to encourage the development and use of regional panels to:

- 1) Identify priorities for each region with respect to aquatic nuisance species.
- 2) Make recommendations to the ANSTF regarding education, monitoring (including inspection), prevention, and control of nuisance species.
- 3) Coordinate, whenever possible, other aquatic nuisance species program activities in each region.
- 4) Develop an emergency response strategy for federal, state, and local entities for stemming new invasions of aquatic nuisance species in the region.
- 5) Provide advice to public and private individuals and entities concerning methods of preventing and controlling aquatic nuisance species infestations.
- 6) Submit an annual report to the ANSTF describing activities within the region related to aquatic nuisance species prevention, research, and control.

The federal ANSTF recognized the Northeast Panel in July of 2001. It includes state, federal and regional government representatives, as well as non-government organizations from the states of New York, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, and Maine, and the Canadian provinces of Nova Scotia, New Brunswick, and Quebec. Once formally recognized by the federal ANSTF, each regional panel becomes eligible for limited funding for implementation.

The Panel's Mission is to protect the marine and freshwater resources of the Northeast from invasive ANS through commitment and cohesive coordinated action. The goals of the Panel are to:

- 1) prevent the introduction, establishment, and dispersal of invasive ANS in the Northeast,
- 2) control the spread of invasive ANS already introduced into the Northeast, and
- 3) mitigate the harmful ecological, economic, social, and public health impacts associated with the introduction, establishment, or spread of invasive ANS in the Northeast.

The Panel currently has active sub-committees addressing policy and legislation; science and technology; communications, education, and outreach; and shipping.

Mid-Atlantic Regional Panel of the Federal Aquatic Nuisance Species Task Force

New York Sea Grant is also a member of the Mid-Atlantic ANS Panel, which serves a similar purpose for the Mid-Atlantic states.

3.4 State Authorities and Programs

CONNECTICUT

Connecticut Department of Environmental Protection (CTDEP)

- **CTDEP Internal Invasive Species Committee**

This committee is made up of representatives from 12 divisions within the DEP. The Committee discusses and develops policy statements, species status assessments and coordinates and prioritizes the Department's actions related to management, education and training related to invasive species issues.

- **CTDEP Bureau of Natural Resources**

Marine Fisheries Division

The Marine Fisheries Division manages the state's marine fishery resources to provide sustainable fish and lobster populations and public benefit. Marine fish populations are managed through population manipulation and habitat preservation and enhancement. The Division also conducts public awareness to promote an understanding and appreciation of fishing, aquatic resources and habitat.

- **Sale of Bait:** Under Section 26-45 of the GSC the CT DEP regulates the sale of bait and requires dealers to obtain a license.
- **Importation/liberation of aquatic vertebrates and invertebrates:** The importation, possession or liberation/stocking of live fish (and eggs) and invertebrates is prohibited without a permit (26-55, General Statutes of Connecticut (GSC)). The Inland Fisheries Division administers and issues permits for marine species in consultation with the Marine Fisheries Division (26-55-1, RCSA).
- **Biological surveys:** The Division performs seine and trawl surveys of Long Island Sound each year. Potential problem species are identified and their status monitored.
- **Importation/liberation of aquatic vertebrates and invertebrates:** The importation, possession or liberation/stocking of live fish (and eggs) and invertebrates is prohibited without a permit (26-55, General Statutes of Connecticut (GSC)). The Inland Fisheries Division administers and issues permits for marine species in consultation with the Marine Fisheries Division (26-55-1, RCSA).
- **Education and Public Outreach:** The Division provides information about ANS to anglers and the general public. The primary vehicle for distribution of information is a two-page spread in the CT Angler's Guide (regulations booklet issued annually) and the CT DEP marine fisheries web site.
- **Control of aquatic flora and fauna:** Although rarely used, CT DEP does have statutory authority (26-22, GSC) to remove undesirable plants or animals from the waters of the state when such measures are in the interest of fisheries management.

Wildlife Division

The control of the invasive aquatic plant *Phragmites australis* has been a major component of recent wetland restoration efforts conducted by the Wildlife Division's Wetlands Habitat and Mosquito Management (WHAMM) Program. Since 1980, control efforts have been conducted on more than 66 sites of *Phragmites* monocultures (Capatosto and Wolfe 2007). The WHAMM Program restores salt water tidal flow to salt marshes, which over 10-20 years replaces *Phragmites* with native vegetation. (*Phragmites* is intolerant of salinities greater than 18 ppt). Since 1980, this method has been applied to ~1,500 acres (Capatosto and Wolfe 2007). Since 1997, the WHAMM program also uses its own specialized low-ground pressure equipment or hires qualified contractors to spray herbicide (Glyphosate) in the fall and then mow (mulch) the dead *Phragmites* stems. Most of this work has been conducted in

tidal wetlands on the lower Connecticut River and along the coast. This method has been effective in controlling *Phragmites*, but it is costly and inefficient. Typically, the herbicide treatment must be repeated over three successive years and current regulations allow only spraying from the ground. Nearly 1,500 acres have been treated in this manner (Capatosto and Wolfe 2007). In the future, the Wildlife Division hopes to amend regulations to allow aerial application of herbicides for *Phragmites*, which would result in fewer chemicals applied to the wetlands and reduce costs by 90%. Also, the WHAMM Program plans on investigating new alternative herbicides for *Phragmites* control.

The Wildlife Division plans to participate in Atlantic Flyway-wide effort to reduce the population of mute swans (*Cygnus olor*), an invasive aquatic species documented to have deleterious impacts to aquatic ecosystems. Presently, there are no mute swan population control measures in Connecticut. Although the hunting of mute swans is prohibited by law (Section 26-94 C.G.S.), the Commissioner of Environmental Protection has authority to implement control measures for mute swans pursuant to Section 26-3 C.G.S.

- **CT DEP Bureau of Outdoor Recreation**

Boating Division

The Department of Environmental Protection, Boating Division posts information and warning signs at all State boat launches and private marinas, explaining the ANS issue and concerns. These signs inform boaters and anglers of the potential for transport of these organisms by boats, trailers and tackle, and what steps to take to prevent accidental introduction. Between Memorial Day and Labor Day, CT DEP Boating Education Assistants travel to State launches to educate boaters on ANS among other boating-related topics. The Division also distributes publications to increase knowledge about ANS concerns. An additional page of ANS information has been published in the CT Boater's Guide. Under the State's mandatory boater education course and certification program, the course textbook has an expanded section on ANS. Through these effective programs, CT boaters and anglers learn about ANS and the recommended actions they can take to prevent further spread.

- **CT DEP Coastal Management Program**

Connecticut's Coastal Management Program is administered by the Department of Environmental Protection (CT DEP) and is approved by NOAA under the federal Coastal Zone Management Act. Under the statutory umbrella of the Connecticut Coastal Management Act (CCMA), enacted in 1980, the Program ensures balanced growth along the coast, restores coastal habitat, improves public access, protects water-dependent uses, public trust waters and submerged lands, promotes harbor management, and facilitates research. The Coastal Management Program also regulates work in tidal, coastal and navigable waters and tidal wetlands under the CCMA (Section 22a-90 through 22a-112 of the Connecticut General Statutes), the Structures Dredging and Fill statutes (Section 22a-359 through 22a-363f) and the Tidal Wetlands Act (Section 22a-28 through 22a-35). Development of the shoreline is regulated at the local level through municipal planning and the zoning boards and commissions under the policies of the CCMA, with technical assistance and oversight provided by Program staff. Among the AIS-related responsibilities of the Coastal Management Program are restoring coastal habitat, and managing and protecting coastal resources in partnership with coastal municipalities.

CT Department of Agriculture

The Connecticut Department of Agriculture is the lead state agency responsible for commercial horticulture as well as shellfish and aquaculture. The Department of Agriculture is represented on the Invasive Plant Council.

- **Bureau of Aquaculture**
 - **Shellfish Sanitation:** The Bureau performs coastal sanitary surveys along Connecticut's 250 mile shoreline and monitors shellfish growing areas in Long Island Sound for the protection of public health by collecting and testing seawater and shellfish meat samples in order to determine levels of bacteria, toxins, and paralytic shellfish poisoning. In response to sanitary

survey results, the Bureau posts areas closed to shell fishing, performs hydrographic dye dilution studies, performs environmental investigations, prepares memorandum of understanding for conditional shell fishing areas, reviews applications for shellfish harvest operations, and initiates emergency closures. The Bureau is also responsible for the sanitary inspection and certification of shellfish dealers involved in harvesting, shucking, depuration, repacking and reshipping of fresh and frozen oysters, clams, and mussels. All shellfish processing and handling operations are inspected at least twice a year as required by FDA. Harvesting boats, vehicles, facilities, equipment, product handling procedures and record keeping are checked for compliance and operational licenses are reviewed and appropriate action taken. The Bureau assists other state, municipal, and federal health officials in investigating food-borne illnesses, product recall, and embargo.

- **Laboratory:** Tests and analyses performed by the laboratory include bacterial levels in seawater and shellfish, various contaminants, marine biotoxin analysis, and shellfish and fish pathology.
- **Shellfish Habitat Management & Restoration:** Program provides a mechanism for shellfish aquaculturalists to obtain underwater lands in Long Island Sound for the purpose of planting, cultivating, and harvesting shellfish and serves as a foundation for the State's multi-million dollar shellfish industry. Bureau provides for the cultivation and propagation of shellfish through the management and restoration of state-owned natural clam and oyster beds. The Bureau issues Natural Bed and Conch Harvest licenses, sets corner markers, plants cultch, maintains spawning stock, monitors predators and diseases, and makes assessments of natural disaster impacts.
- **Aquaculture Development and Coordination:** This program is responsible for planning and coordinating aquaculture development including development and oversight of legislation, review of NPDES and Coastal Zone applications, liaison between industry and the regulatory community, promotion, marketing technology transfer and assistance, communications, and addressing issues of regional and national concern.

Connecticut State Legislature, CT Invasive Plant Council

The Connecticut General Assembly authorized the formation of the Invasive Plant Council (IPC) in 2003, and has included 21 aquatic plant species on its list of 81 plants banned between 2003 and 2005. In 2007, the Connecticut General Assembly established a non-lapsing invasive species detection and control account to be expended by the CT DEP Commissioner for the purposes of controlling invasive species, educating the public about such species, awarding grants to municipalities for the control of invasive species on public lands and waters, and funding for inspectors from the Department of Agriculture and the Connecticut Agricultural Experiment Station for the control of invasive species.

NEW YORK

New York Invasive Species Council

The Invasive Species Council was established in 2007 by the New York State legislature. It consists of the heads of State agencies and includes a new program within the NYS DEC to facilitate the State's ongoing efforts to regulate invasive species in New York (see NYS DEC, ISEG Program). The roles of the Council are to create a State-wide management plan, recommend projects for funding, create an on-line database; review and reform regulatory processes to remove unnecessary impediments to the restoration of invaded ecosystems; and establish a broad array of stakeholder industries to develop and/or adopt voluntary codes of conduct. It is also responsible for submitting a report prior to 1/1/09 that develops a four-tier classification list for nonnative wildlife and plant species (prohibited species, regulated species, unregulated species, and unlisted species).

New York State Invasive Species Task Force (ISTF)

The NY State Invasive Species Task Force was established in 2003 and is chaired jointly by the Commissioner of Agriculture and Markets and the Commissioner of Environmental Conservation. In 2005, the task force completed a report, which outlined twelve recommendations for addressing the environmental, ecological, agricultural, economic, recreational and social impacts caused by invasive species in NY ([http://www.dec.ny.gov/docs/istfreport1105\(1\).pdf](http://www.dec.ny.gov/docs/istfreport1105(1).pdf)). Other members of the task force include the NYS Department of Transportation, NYS Thruway Authority (and Canals Corporation), NYS Museum (and Biodiversity Research Institute), NYS Office of Parks, Recreation and Historical Preservation, NYS Department of State, Adirondack Park Agency, New York Sea Grant, Cornell University, Invasive Plant Council of NYS, The Nature Conservancy (TNC), NYS Farm Bureau, Empire State Marine Trades Association, and the New York State Nursery and Landscape Association. Among the recommendations of the Task Force was the creation of a Center for Invasive Species Research and that New York State fund demonstration projects. The latter is being accomplished through State Eradication Grant Programs for both aquatic and terrestrial species, and eight formed or forming regional Partnerships for Regional Invasive Species Management (PRISMs; see NYS DEC and LIISMA below).

New York State Department of Agriculture and Markets (NYS DAM)

NYS DAM is taking the lead on preparing a comprehensive invasive species management plan for the State of New York. DAM is also responsible for the administration of the USDA Cooperative Agricultural Pest Survey (CAPS) program within the State. It co-chairs the ISTF and will co-chair the NY Invasive Species Council, once established.

New York State Department of Environmental Conservation

The NYS DEC is responsible for the management of fish and wildlife in the State of New York, including aquatic and marine species. It co-chairs the ISTF and will co-chair the New York Invasive Species Council, once established.

- **Bureau of Marine Resources**

The Bureau of Marine Resources is responsible for the management of living marine resources and their habitats within the Marine and Coastal District of New York State. The Bureau is divided into three major program areas which deal with finfish and crustaceans, shellfish (resource management and sanitation), and marine habitat protection (administers the state's Tidal Wetland Act and the state's Protection of Waters and federal Clean Water Act Section 401 Water Quality Certification permit programs).

- **Center for Invasive Species Research**

A coordinator for the Center was hired, and NYS DEC will be contracting with Cornell University to establish a NYS Invasive Species Research Institute. NYS DEC is also funding priority research projects such as biocontrol research on controlling *Phragmites* in cooperation with NYS Department of Transportation.

- **Invasive Species Management Coordinator**

In 2006, NYS DEC hired an invasive species coordinator. Among the coordinator's roles and responsibilities are to work with the PRISMs and oversee the Invasive Species Eradication Grant Program for terrestrial and aquatic species.

- **Partnerships for Regional Invasive Species Management (PRISM)**

One of the recommendations of the NYS Invasive Species Task Force was to fund demonstration projects. New York State is accomplishing this by establishing eight PRISMs (Partnerships for Regional

Invasive Species Management) by geographic region. PRISMs are composed of a diverse stakeholder base, including state agencies, resource managers, non-governmental organizations, industry, resource users, and others. Responsibilities include planning regional invasive species management, developing early detection and rapid response capacity, implementing eradication programs, education, coordinating PRISM partners, recruiting and training volunteers, and supporting research through citizen science. NYS DEC is responsible for awarding contracts for fiscal administration of each PRISM.

Long Island Invasive Species Management Area (LIISMA)

The Long Island Invasive Species Management Area is the PRISM that covers Long Island. Each PRISM works with its regional volunteers. TNC on Long Island is coordinating this PRISM's efforts. See above.

Lower Hudson PRISM

The Lower Hudson (LH) PRISM, which includes western LIS, is presently being coordinated by the TNC with assistance from the Palisades Interstate Park Commission and NYS DEC. It is anticipated that the Highlands Environmental Research Institute (HENRI) will house the PRISM.

- **(Aquatic) Invasive Species Eradication Grant (ISEG) Program**

Beginning in 2006, the New York State Department of Environmental Conservation (DEC) provides provide State assistance funding through reimbursement for projects to eradicate aquatic species identified as being invasive within water bodies and wetlands of New York State from the Environmental Protection Fund to fund Invasive Species Eradication Grants. Acceptable projects are proposals to kill and/or permanently remove plants or animals that meet the definition of aquatic invasive species or aquatic nuisance species from waterbodies or wetlands in New York State. The money allotted annually for this fund is shared between the Aquatic Invasive Species Eradication Grant Program and the Terrestrial Invasive Species Eradication Grant Program. Grants can only be awarded to municipalities and Not-For-Profit Corporations (NFPs). NYS DEC matches applicant expenditures on a 1:1 basis.

New York State Department of State

- **Division of Coastal Resources**

The Division of Coastal Resources works in partnership with community groups, non-profit organizations, state and federal agencies, and local governments to make communities better places. It is involved in programs and initiatives that help revitalize, promote and protect New York's communities and waterfronts. The Division works with local governments and communities to prepare Local Waterfront Revitalization Programs, and provides technical and financial assistance to communities for plans and projects expanding public access, reinvigorated urban waterfronts, restored habitats, and strengthened local economies. The Division is responsible for implementing the Federal Coastal Zone Management Act in New York State, implementing the State's Waterfront Revitalization of Coastal Areas and Inland Waterways Act, developing Local Waterfront Revitalization Programs and Harbor Management Plans, providing planning and technical assistance for redevelopment of brownfields, abandoned buildings and deteriorated urban waterfronts, revitalizing community centers, regional planning for the Long Island Sound shore and the South Shore Estuary Reserve, protecting water quality through intermunicipal watershed planning, planning for the prevention and mitigation of coastal hazards, protecting and restoring coastal habitats, planning for the preservation of historic resources, maritime heritage, and scenic resources, implementing New York's coastal policies through consistency review, and investing in improvements to waterfront areas through state and federal grant programs.

NYS Department of Transportation

The NYS Department of Transportation (NYS DOT) considers and addresses, to the extent practicable, the impacts of invasive species in all aspects of project scoping, planning, design, construction, operation and maintenance for all projects and activities. The guiding principles for the DOT's invasive species program are education and outreach; inventory; early detection and rapid response; prevention; control; monitoring; and research. All Department capital projects, and appropriate maintenance activities and roadside operations shall consider and address, as practical, the potential environmental effects of invasive species. This process and analysis includes, at a minimum, an inventory of the project area for priority invasive species (including purple loosestrife and *Phragmites* or common reed). (See procedures manual; <https://www.nysdot.gov/portal/page/portal/divisions/engineering/environmental-analysis/manuals-and-guidance/epm/repository/4-8invas.pdf>.)

New York State Office of Parks, Recreation and Historical Preservation

The New York State Office of Parks, Recreation and Historical Preservation (NYS OPRHP) has been involved for more than 10 years in invasive plant issues, and participated on the Invasive Plant Council (IPC) of NYS from 1999 through 2006. OPRHP was also an active participant in the State Invasive Species Task Force, and will also be a member of the recently-established Invasive Species Council. The threat of invasive plants ranked third on the list of threats to the parks' natural resources, after habitat loss and recreational uses. A six-year biodiversity study through the State Parks was recently completed by the Natural Heritage Program, a cooperative NYS DEC and TNC program. The project included mapping of ecological communities; the identification of invasive species was conducted within the parks, although much of it was not mapped. The project also included the identification of threats and management recommendations with respect to the natural communities / rare species that were identified. Statewide, approximately 20% of the threats and management related to invasive plants. OPRHP has also worked with DEC and the IPC to develop a New York State standardized database for invasive plants. Early detection and rapid response efforts have been conducted in a number of areas, on a variety of invasive plants species, including *Phragmites* and purple loosestrife. OPRHP is also involved in training and education regarding invasive species, and is taking an active role in the PRISMs (see NYS Invasive Species Task Force).

New York Invasive Plant Council

The New York State Invasive Plant Council works to raise the profile of invasive plants, their threats, and appropriate management practices. They maintain a list of the most serious invasive species in New York State (www.ipcnys.org) and are developing an invasive plant database to provide reliable information about the distribution and management of invasive plants throughout New York and its bordering states and provinces. The plan is to use IPANE (Invasive Plant Atlas of New England) as a model which allows volunteers and land managers to enter data online. The state-wide database will include all taxa and EDRR will be handled on both a site-based and species-based level.

There are about 250 species on the 5-tiered State Master Invasives list. These 5 tiers are: Presence Established (PE)—4 or more known locations in the region; Early Detection (ED)—<4 known occurrences in the region; Approaching Region (AR)—known to be in adjacent region or state; Not Applicable (NA); and Unknown (U).

3.5 Industry

Millstone Environmental Laboratory, Dominion Nuclear Power

The staff of the Millstone Environmental Laboratory, as part of their required monitoring program for the nuclear power generating facility in Waterford Connecticut, has collected extensive long-term data on the flora and fauna in their sampling sites, as well as the environmental conditions. This monitoring program has led to the reporting of several invasive species in Long Island Sound, including most recently the red

alga, *Grateloupia turuturu*. The Millstone monitoring program serves as one of the primary ongoing monitoring sites for LIS.

3.6 Universities

Connecticut Sea Grant College Program, NOAA National Sea Grant / University of CT

Connecticut Sea Grant has been a leader of aquatic invasive outreach and education efforts in Connecticut since 1991, coordinating the ad hoc state Zebra Mussel Task Force, producing the Northeast regional newsletter, *Aquatic Exotics News*, and co-sponsoring two Northeast regional conferences on nonindigenous aquatic nuisance species held in Connecticut in 1995 and in Vermont in 1997. Connecticut Sea Grant is an active member of the Northeast Regional ANS Panel, serving on the Communication, Education and Outreach and Shipping sub-committees, was a participant in the National Zebra Mussel Training Initiative, and has produced signs, fact sheets, field cards, poster, website <www.seagrant.uconn.edu/LISinvasives.htm> and a video on various AIS including zebra mussels, aquatic weeds, and introduced species in LIS. Connecticut Sea Grant, along with CT DEP, secured the National Sea Grant funding that supported the development of the management plan for Connecticut, and later secured the funding from the New England Interstate Water Pollution Control Commission to support development of this Long Island Sound Interstate Aquatic Invasive Species Management Plan.

New York Sea Grant Institute, NOAA National Sea Grant / Stony Brook University and Cornell University

New York Sea Grant has been funding and implementing aquatic nuisance species research and extension outreach programs since the early 1980s, when it began responding to information and education needs pertaining to Eurasian water milfoil and nuisance algae blooms on Lake Ontario and the Finger Lakes. Since the introduction of the zebra mussel into the Great Lakes Basin in 1988, New York Sea Grant has been a national leader in AIS research and outreach. New York Sea Grant is an active member of both the Northeast and Mid-Atlantic regional ANS Panels and a staff member serves on the Communications, Education, and Outreach Committee of the National ANSTF and is a member of the National Invasive Species Advisory Committee, which provides advice and information to the National Invasive Species Management Council. New York Sea Grant offer aquatic nuisance and invasive species training for educators and develops educational materials for distribution to those audiences. Since 2001, NYSG has invested more than \$1.5 million in both freshwater and marine AIS research. The only nationwide zebra mussel economic impact study to date was undertaken by NYSG in 1995. NYSG is also involved in AIS outreach activities throughout the State's Great Lakes, Finger Lakes, St. Lawrence River, Hudson and Peconic estuaries and in the LIS and Atlantic coast regions. Since 1995, NYSG has invested approximately \$1 million on AIS education and outreach, including the National Aquatic Nuisance Species Clearinghouse.

- **National Aquatic Nuisance Species Clearinghouse**

Established in 1990, the Clearinghouse publishes quarterly information on research, meetings, legislation, and sightings of important AIS. The Clearinghouse serves as a repository of published information on AIS encompassing both peer reviewed and "gray" publications. Financial support for the Clearinghouse has been provided by the Empire State Electrical Energy Research Corporation and NOAA National Sea Grant.

A number of faculty researchers in the Long Island Sound region are conducting research on aquatic invasive species, addressing vectors and pathways, ecological impacts, control and eradication, and monitoring and assessment. They are located at colleges and universities including:

Connecticut College
Cornell University

Ecology and Management of
Invasive Plants Program
(<http://invasiveplants.net/>)
Fairfield University
State University of New York (SUNY),
Stony Brook
State University of New York (SUNY),

Purchase
University of Connecticut
Invasive Plant Atlas of New England
University of Hartford
University of New Haven
Williams College – Mystic Seaport

3.7 Local Authorities and Programs

Municipal Shellfish Commissions

Shellfisheries not within the area of the State of Connecticut, as defined by state statute, are within the jurisdiction and control of the towns in which they are located. Shellfish commissions may lease grounds for commercial purposes, and/or establish and maintain grounds for recreational shell fishing. They issue shell fishing permits, regulate quantities harvested, enforce local shellfish regulations, and work to ensure cultivation, enhancement, and restoration of shellfish grounds within their jurisdiction, in conjunction with the CT Department of Agriculture and the CT Department of Environmental Protection.

(See NYS DEC, Bureau of Marine Resources, for New York)

Harbor Management Commissions

In Connecticut, a Harbor Management Commission may be established by any municipality having within its limits navigable waters (as defined by state statute). Members may include representatives of various commissions including planning, zoning, conservation, shellfish, and flood control. Harbormasters serve as ex officio members. The responsibilities of these commissions include development of harbor management plans and implementation of the plans following review and acceptance by the State of Connecticut. Waters within the territorial limits of the municipality and below the mean high water are under the jurisdiction of the Commission.

In New York, local communities can develop harbor management plans with the assistance of the New York State Department of State, Division of Coastal Resources. Guidelines are available. Local governments can have the authority to regulate all uses and structures for a broad set of purposes to address the conflicts that are specific to their harbor and achieve the mix of harbor uses that are appropriate. Harbor management planning enables local governments to address a wide range of uses in harbor and nearshore areas. (http://www.nyswaterfronts.com/waterfront_working_harbormgmt.asp)

Suffolk County, Long Island, NY

In 2007, Suffolk County passed legislation that includes a “do not sell” list of plants that will take effect beginning January 2009. Legislation also calls for creation of permanent advisory board with stakeholders to ensure all aspects of Suffolk County Invasive Species Management Program are properly implemented. This is the first legislation of its kind in New York State (<http://www.co.suffolk.ny.us/legis/resos2007/i1144-07.htm>).

Nassau County, Long Island, NY

Nassau County has been developing an invasive species management plan over the last year which is nearing completion. This plan will be accompanied by legislation similar to that recently passed by Suffolk County (see above).

3.8 Non-Profit Organizations

Non-profit organizations, working through local school systems, community centers and other agencies, promote awareness of aquatic invasive species of Long Island Sound through programs, displays, signage and exhibits. Educational materials developed by government agencies and universities are used in conjunction with information resulting from research by all agencies conducted throughout Long Island Sound in this public outreach and education effort.

Connecticut Audubon
Mystic Aquarium and Institute for Exploration
Save the Sound / Connecticut Fund for the Environment
SoundWaters
The Maritime Aquarium at Norwalk
The Nature Conservancy

SECTION 4. GOAL AND OBJECTIVES

GOAL: *The States of Connecticut and New York, in collaboration with relevant federal agencies, academic institutions, and non-governmental organizations, will adopt and implement the Long Island Sound Interstate Aquatic Invasive Species Management Plan, in order to prevent the introduction of new marine (aquatic) invasive species and minimize the ecological, socioeconomic, and public health impacts of existing marine (aquatic) invasive species in Long Island Sound.*

In order to achieve this goal, a series of objectives have been defined for the next three years (these are listed below and described more fully in Section 5). Note that while the LIS AIS Working Group designated “*the prevention of future anthropogenic introductions of AIS into Long Island Sound*” as *the most important objective in this plan* (objective 3, below), the objectives are listed in a more procedural order, starting with coordination. Therefore, the number associated with each objective does not necessarily reflect its perceived order of importance. The specific actions or tasks outlined in Section 5 and in the Implementation Table correlate directly to these eight objectives.

The Objectives of the Long Island Sound Interstate Aquatic Invasive Species Management Plan are to:

1. Coordinate AIS-related activities of the relevant state and federal authorities for Long Island Sound
2. Secure adequate funding and staff to implement AIS management objectives for Long Island Sound
3. Prevent future anthropogenic introductions of AIS into Long Island Sound
4. Detect and monitor new occurrences, range expansions, and existing populations of AIS in Long Island Sound
5. Initiate risk management for all new invasions in Long Island Sound and for existing AIS in LIS as appropriate
6. Increase public awareness of AIS in Long Island Sound through education and outreach
7. Identify research priorities and potential funding sources for AIS in Long Island Sound
8. Strengthen enforcement of existing regulations, revise regulations as needed, and strive for future AIS-related legislation or regulations that are comparable in Connecticut and New York

SECTION 5. OBJECTIVES, STRATEGIES, AND ACTIONS

NOTE: Under each strategy below (e.g., 1A1), the following designations for priority, funding, and FTEs, are listed. Priority = High Priority Action or Standard Priority Action (Standard Priority items are less important than High Priority items); Funding / FTE = Known (FTE and funding source and amount indicated) or TBD (unidentified at present, to be determined)

Introduction and spread prevention are critical elements of this AIS management plan since control of introduced species in marine systems is difficult and often unfeasible. However, there is growing evidence that rapid response eradication efforts in marine and estuarine systems can be effective in eliminating new invasions (Anderson 2007; Chang and Ruiz 2007; Gould et al. 2007; Montgomery 2007; Weiskel et al. 2007). Once a new invasive population has been discovered, a pre-determined protocol must be activated quickly to assess how to respond with limited resources (management and control, attempt eradication, do nothing) (Chang and Ruiz 2007).

Objective 1: Coordination

1 A Establish Coordinating Entities

Current AIS management efforts focused on Long Island Sound are not fully coordinated among various state and federal agencies, academic institutions, businesses and NGOs. Effective and efficient implementation of AIS monitoring, prevention strategies, and management activities will require improved coordination throughout the LIS region.

1 A 1 Establish Coordinating Committee

A standing LIS AIS Coordinating Committee will be established under the auspices of the EPA Long Island Sound Study, composed of state and federal representatives of authorities and programs dealing with AIS, scientific experts, as well as representatives of constituency groups likely to be affected by such programs. This group will meet at least semi-annually and its CT and NY co-chairs will report to the LISS Management Committee.

Priority:	High
Funding:	Staff time commitments from agencies / institutions represented on coordinating committee (e.g., EPA LISS, CT DEP, NYS DEC, others)
FTE:	about 1 week per person on committee (< 0.1 each) / year

1 B Coordinate Within the LIS Region

Coordination of Long Island Sound AIS management activities between Connecticut and New York, given the current allocation of limited resources for AIS management, will require an on-going designation of priority species. As this plan is implemented and monitoring efforts enhanced, improved knowledge of AIS distribution and impacts will be used to continually update management priorities. Many of the following tasks are in progress as part of this plan development.

1 B 1 Coordinate with CT and NY ANS / AIS Management Plans

Connecticut adopted its ANS Management Plan in 2007 and New York is in the process of creating a comprehensive invasive species management plan. This interstate plan for Long Island Sound should complement the management objectives for marine waters in those plans, as they are developed and implemented.

Priority:	High
Funding:	Staff time commitments from agencies / institutions represented on coordinating committee (e.g., EPA LISS, CT DEP, NYS DEC, others)

FTE: < 0.1 each / year

1 B 2 Develop risk assessment, management and policy procedures

The LIS AIS Coordinating Committee will review existing models and establish a procedure / framework by which risk assessment, management, and policy decisions will be made regarding newly-identified AIS in LIS. The Committee will solicit participation from the academic, regulatory, and non-governmental organization communities to perform risk assessments (if they do not already exist). If a risk assessment reveals that mitigation is justified for an organism, then the Committee will attempt to match mitigation options and resources available with identified risks.

Priority: High

Funding: Staff time commitments from agencies / institutions represented on coordinating committee (e.g., EPA LISS, CT DEP, NYS DEC, others)

FTE: < 0.1 each / year

1 B 3 Establish Annual Work Plan

The LIS AIS Coordinating Committee will develop an annual work plan, based on the objectives, priorities, and tasks outlined in this management plan. Additional input from outside of the coordinating committee will be sought. The following items will be given consideration in this annual work plan:

- ◆ Review existing / develop new lists of established and potential AIS & their management class designations; vector lists; monitoring sites
- ◆ Review protocols for each list
- ◆ Develop and announce research priorities (e.g., vector or species research, standardized monitoring, analysis of effectiveness of various rapid response techniques)
- ◆ Facilitate coordination among funding agencies
- ◆ Review existing and proposed LIS AIS-related regulations in Connecticut and New York, and where appropriate, recommend the states consider the institution of equitable or parallel regulations.

Priority: High

Funding: <\$2k per year

FTE: est. 15 people, 2-4 days each per year

1 B 4 Evaluate AIS Program

The Co-chairs of the LIS AIS Coordinating Committee, in conjunction with committee members, will be responsible for overseeing the overall progress of the AIS management activities as outlined in the plan, prepare an annual progress report, and outline budget needs and priorities. The measurement and documentation of any beneficial impacts due to implementation will be included as part of the evaluation process.

Priority: Standard

Funding: <\$1k

FTE: <0.1/year

1 C Coordinate Beyond the LIS Region

AIS management is a regional issue, unconflicting to political boundaries. Formal mechanisms for interstate, national and international coordination will be necessary to limit new introductions and, where possible, the spread of established AIS populations in marine systems. Coordination with appropriate regional/national entities will be undertaken as appropriate.

1 C 1 Coordinate Regionally

Connecticut, New York, and Rhode Island are actively represented on the Northeast Regional ANS Panel through the participation of several appointed members; New York is also represented on the Mid-Atlantic ANS Panel, and the National Invasive Species Advisory Committee. Continued participation on these Panels will ensure better coordination with state and federal agencies and industry representatives to address AIS issues of mutual concern, and heightened awareness of regional priorities. More efficient use and sharing of available resources and expertise is facilitated via participation in the Panels. Because New York and New Jersey share a major harbor, key AIS contacts from New Jersey will be invited to participate in Coordinating Committee discussions by conference call as appropriate.

Priority: Standard
Funding: <\$2k per year for representative members
FTE: <0.1/year

1 C 2 Encourage Reporting

The designated CT and NY contacts for reporting new sightings of marine species will be advertised and utilized; reportings of new marine species, once confirmed, will be shared with the LIS Coordinating Committee co-chairs. A regional database of marine invasive species has been established through MIT Sea Grant, including the use of Geographical Information System (GIS) to enable the production of maps URL: <http://chartis.mit.edu/mitis/>. The LIS Coordinating Committee will strongly encourage that reports of new sightings be added to the database in a timely manner. The database link will be provided via the LIS ANS web page.

Priority: Standard
Funding: <\$1k per year per contact; <\$1k per year CTSG (web page)
FTE: <0.1/year

Objective 2: Funding

Secure adequate funding and staff to implement the AIS management plan objectives for Long Island Sound.

2 A Fund AIS Management Program

The successful implementation of the LIS AIS plan will require a coordinated effort between the States of Connecticut and New York (most likely through the state AIS coordinators or their designees), in concert with the Long Island Sound Study Management Committee. Specific actions outlined in the management plan will be funded through targeted grants or other fundraising activities.

2 A 1 Identify and Secure Funding

One of the first activities of the LIS AIS Coordinating Committee will be to identify and pursue funding opportunities for specific AIS plan tasks outlined as priorities but currently without identified funding sources. Other groups interested in assisting in the implementation of the plan, including Working Group members, will also be encouraged to seek funding support for specific components of the plan.

Priority: High
Funding: TBD
FTE: Collectively, about .25 FTE per year

Objective 3: Prevent Future Anthropogenic Introductions

The objective is to prevent or reduce the number of new anthropogenic introductions of aquatic invasive species to Long Island Sound.

3 A Assess and Minimize Introduction Risks

Long Island Sound faces the risk of species introductions that have proven to be damaging in other Northeastern states or regions. Consistent employment of a standard methodology for evaluating the risk of introduction of these species will be necessary to identify and implement species-specific prevention measures. A better understanding of the specific role various transport vectors play in AIS introductions and spread in Long Island Sound and nearby regions is needed to determine the best way to interrupt those vectors. Careful study of species introductions through these vectors, followed by efforts to communicate with related industry representatives and regional panels, will be a critical first step in reducing AIS transport. The use of state and federal regulations and legislation to address AIS are covered in 8 B 2.

3 A 1 Assess Introduction Risks

The LIS AIS Coordinating Committee will charge a subcommittee or graduate fellow with the responsibility for updating the current risk analyses and conducting new ones for selected species, focusing on the risk of the introduction and spread of priority species or major taxa by a range of vectors. *(Note: The Canadian Department of Fisheries and Oceans charges risk assessment tasks to its Introductions and Transfers Committee, a technical committee of six members. If an intentional introduction is being considered, then the party wishing to introduce the organism might be tasked with assessing the associated risks. Following this model, the LIS AIS Coordinating Committee may wish to charge more than one unbiased assessor with the responsibility for completing a species assessment, to ensure the process is as well-informed as possible.)* As part of the work plan, recommendations for any revisions to the priority species and vector lists will be addressed. Priority species include nonindigenous species that have become established in regions north and south of Long Island Sound that tend to exhibit invasive characteristics. Risk of their introduction to LIS will be determined using the ANS Task Force Risk Analysis Review Process for assessing generic nonindigenous aquatic organisms (Risk Assessment and Management Committee 1996), and to facilitate assignment of management classification (1 to 5; see section 2.5). Information related to topics such as research needs, species movements, and risky handling practices can be incorporated into these analyses. Environmental characteristics that make a particular habitat susceptible to invasions will also be considered in these analyses. Species will be ranked in terms of potential threat.

Priority:	Standard
Funding:	TBD
FTE:	TBD

3 B Minimize Marine Commerce Introductions

Effective management of AIS requires that industries that can serve as vectors of transport or introductions collaborate on AIS prevention efforts. In coordination with industry representatives, Best Management Practices will be developed to minimize potential introductions of invaders through priority vectors. This will involve assessing industrial vectors, prioritizing management needs, assessing existing BMP information and developing new material. Ad hoc groups will be established as needed that include representatives from industries identified as potential pathways for introduction. These groups should identify priority preventative strategies and educational needs.

3 B 1 Minimize Introductions through Commercial Shipping

The Coordinating Committee will strategize with local US Coast Guard contacts and local port authorities to assess the local magnitude of the hull fouling and ballast water vectors among commercial ships entering and leaving LIS, and will support their efforts to enforce current USCG ballast water exchange and reporting requirements. The Committee will also promote regional awareness of existing ballast water regulations, and review ballast water exchange reports for ships entering LIS waters to assess vector magnitude. Local marinas and shipyards will receive information about the problems of AIS and

suggested best management practices to avoid discharge of organisms into local waters during hull cleaning procedures.

Priority: Standard
Funding: TBD
FTE: <0.1 / year

3 B 2 Minimize Aquaculture / Hatchery Introductions

CT DA/BA, CT DEP, and NYS DEC will review and strengthen (as necessary) protocols in place to prevent the introduction of new, non-target and/or pathogenic species via intentional releases or escapees from agriculture facilities or hatcheries.

Priority: High
Funding: CT DEP <\$1K/year; CT DABA <\$1K/year; NYS DEC <\$1K/year
FTE: <0.1 / year each

3 B 3 Minimize Commercial Bait Industry Introductions (see also 3 C 2)

The results of ongoing research by faculty at the University of Connecticut and SUNY Purchase (*below and also listed under 7 B 1*) investigating species of live marine bait typically sold locally, types of organisms associated with the seaweed used to pack the worms and crabs, will be shared with wholesalers of live marine bait, and best management practices developed to reduce risk of inadvertent introductions of non-native organisms.

CTSG will complete a Northeast Sea Grant regional project, working with bait and tackle shops throughout the Northeast to distribute an educational sticker/placard (in multiple languages) that provides guidance on proper disposal with live bait purchases (see 3 C 2).

Priority: High
Funding: EPA LISS and CTSG (\$102K over 15 months); NSGO and CTSG \$6-8K
FTE: < 0.1 CTSG

Yarish, C., R. Whitlatch, G. Kraemer, and S. Lin. 2006-2007. Multi-component evaluation to minimize the spread of aquatic invasive seaweeds and harmful algal bloom microalgae via live bait vectors in Long Island Sound. University of Connecticut and State University of New York (SUNY), Purchase.

3 B 4 Minimize Pet Trade Introductions

The LIS AIS Coordinating Committee will utilize the resources of the national public awareness campaign, Habitattitude™, to help raise awareness of the importance of properly disposing of unwanted pets and aquarium plants. (Habitattitude™ was developed by the USFWS, NOAA Sea Grant, and the Pet Industry Joint Advisory Council. CT Sea Grant and NY Sea Grant are partners in this program, with access to the campaign materials).

Priority: Standard
Funding: TBD
FTE: TBD

3 C Minimize Marine Recreation Introductions

Prevent new introductions of AIS via marine recreational boating and fishing (both boat- and shore-based) through expanded educational efforts and strict enforcement of existing laws.

3 C 1 Minimize Recreational Boating Introductions through Hull Fouling

Outreach programs will be utilized to raise boater awareness of hull fouling as a vector of AIS and share examples of best management practices that can be employed to minimize potential introductions.

Materials from the USFWS/Federal ANSTF Protect Your Waters! national public awareness campaign will be utilized on various signs and included in pamphlets and guides.

Priority: High
Funding: CTSG \$14K
FTE: CTSG < 0.1/year

3 C 2 Minimize Bait Introductions Through Angling (see also 3 B 3)

Use research and education programs to assess risk and raise angler awareness of the potential for AIS introduction through the improper disposal of baitworms, other live bait, and their packing materials. CTSG will complete a Northeast Sea Grant regional project, working with bait and tackle shops throughout the Northeast to distribute an educational sticker/placard (in multiple languages) that provides guidance on proper disposal with live bait purchases. See 3 B 3.

Priority: High
Funding: CTSG \$6-8K; EPA LISS and CTSG \$102K over 15 months
FTE: CTSG <0.1/year

3 D Minimize Introductions by Education and Research

Prevent new introductions of AIS by aquatic research facilities and public aquaria. Marine research facilities often hold nonindigenous organisms for experimental and display purposes. Maintenance of these live species often requires the exchange of water with the natural environment, providing the opportunity for the release of these species, which may have microscopic life history stages.

Furthermore, experimentation with live nonindigenous organisms may be conducted in the natural environment, requiring careful controls to prevent their release or escape.

3 D 1 Promote Established Research Protocols

The LIS AIS Coordinating Committee will work with the LISS Management Committee and other regional funding agencies to ensure that Long Island Sound researchers working with AIS are aware of federal and state protocols for working with AIS and policies regarding discharges from running seawater laboratories. Links to pertinent web sites will be posted on the LIS Invasives web site. Information on reviewing proposals involving AIS have been developed (ANSTF 1994).

Priority: High
Funding: CTSG <\$1K/year (web site); Coordinating Committee <\$1K/year
FTE: < 0.1 / year all

3 D 2 Encourage Aquaria AIS BMPs

The LIS AIS Coordinating Committee will encourage public aquaria partners in the Long Island Sound region to review and update, as needed, best management practices for treatment of wastewater and release of unwanted organisms that meet federal and state requirements for discharges.

Priority: High
Funding: <\$1K/year per aquarium facility
FTE: <0. 1/ facility / year

3 D 3 Minimize Consumer Introductions through Biological Shipments

An outreach program will be developed in concert with the NY State Marine Educators Association (NYSMEA), the Science Teachers Association of New York State (SCSTA), the New York Biology Teachers' Association, Southeastern New England Marine Educators (SENEME), and the Connecticut Science Teachers Association (CSTA) to share information and protocols on the proper use and disposal of AIS in classrooms, to include purchases from biological supply companies.

Priority: High
Funding: TBD

FTE: TBD

3 E Minimize Introductions through Live Seafood Trade

AIS can be inadvertently or intentionally introduced through many methods of supply and transport, including e-commerce and air travel, as well as by restaurants, the live seafood trade, and releases by humans.

3 E 1 Promote Proper Use and Disposal of Live Seafood

Recognizing that some of these vectors (e.g., air travel and e-commerce) are beyond the scope of this plan, a multi-lingual outreach program to address live seafood introductions developed by MIT Sea Grant for the Northeast will be shared with seafood industry members via the LIS AIS web site and the Connecticut and New York Seafood Councils (<http://massbay.mit.edu/seafood>).

Priority: High
Funding: TBD
FTE: TBD

3 F Minimize Introductions through Habitat Restoration

Managers of coastal habitat restoration projects should consider carefully the plant and/or animal species used, to avoid introducing new problems through the use of non- native, invasive species.

3 F 1 Minimize AIS Introductions during Restoration

Information on prohibited species, and native alternatives should be made readily available through the LIS AIS web site.

Priority: High
Funding: TBD
FTE: TBD

Objective 4: Detect and Monitor

Detect and monitor new occurrences, range expansions, and existing populations of AIS in Long Island Sound, to establish a baseline of species diversity and relative abundance.

4 A Strategize Early Detection, Monitoring & Assessment (EDMA)

A coordinated Early Detection, Monitoring, and Assessment (EDMA) plan to monitor for new introductions and the spread of AIS in Long Island Sound is a critical element of this plan. The strategy must include early detection of new infestations and monitoring of known populations, following state standard reporting protocols, and assessment of risks associated with any newly reported introduction or new populations of existing invasive species. Resources will be focused on priority vectors and species identified by the Coordinating Committee.

4 A 1 Develop EDMA Strategic Plan / Protocol / Procedure

The Coordinating Committee (or an appointed sub-committee) will evaluate existing and potential efforts related to early detection, monitoring, and assessment of new or expanding invasions (EDMA). In Long Island Sound, sentinel sites will be established in the eastern, central, and western basins for long-term monitoring. The sub-committee will decide issues such as what range of habitats within these sites will be studied, including those sites that have been relatively unstudied in the past, and those sites that are susceptible to invasion, what species will be monitored and how, etc. The Committee or designated sub-committee might consider the feasibility of semi-automated molecular surveys for harmful algal blooms (HABs). Temperature trends (and other physical data) from existing data sources will also be reviewed

(sea level rise and global warming could affect the spread of some AIS). This monitoring will require trained professionals for long-term monitoring (which implies institutional ability and commitment).

Priority: High
Funding: TBD (but expected to be high)
FTE: TBD

4 B Standardize a Survey Protocol

4 B 1 Develop Standardized Approach

Identify groups or organizations that conduct monitoring in Long Island Sound and by what methods. Such groups may include: University of Connecticut (MY SOUND), SUNY Stony Brook, Millstone Environmental Laboratory, NHEERL, EMAP (Triangle Park, NC), CT Department of Agriculture, CT DEP Marine Fisheries Division, NYS DEC Marine Resources, Fish and Wildlife Federation, Project O, Schooner, Inc., and SoundWaters. The LIS AIS Coordinating Committee will develop a standardized approach (with training) for all sentinel sites within the Sound, which could be adopted by those interested groups already collecting data as part of their regular activities or programs at other locations. Responsibility for coordination of the monitoring effort, data reporting methodology, and standardizing the data collection must be determined before implementation.

Priority: High
Funding: TBD
FTE: TBD

4 B 2 Develop a Quality Assurance/Quality Control Protocol

Develop a QA/QC protocol to ensure use of standardized methods among all participants monitoring at the sentinel sites. See 4 B 1.

Priority: Standard
Funding: TBD
FTE: TBD

4 C Implement Monitoring Program

4 C 1 Develop and Train New Monitors

Identify potential volunteer groups or organizations willing and able to conduct informal monitoring (such as recreational divers (SECON), commercial fishermen and anglers, coastal land owners, state and local parks, land trusts, volunteers, marinas, local schools, scout groups, marine education groups). The LISS Citizens Advisory Committee will be consulted for input on potential candidate groups). Develop training programs for monitors that includes reporting protocols and specimen collection and preservation for identification by experts.

Priority: Standard
Funding: <\$1K.year per volunteer
FTE: <0.1 / year / volunteer

4 C 2 Conduct and Evaluate Monitoring

Implement EDMA plan as developed (see 4 A and 4B). Coordinate with informal monitors (see 4 C 1).

Priority: High
Funding: TBD (expected to be high)
FTE: TBD

4 D Create Library of Existing AIS

4 D 1 Maintain and Update a Library of Existing AIS

Work with museums (e.g., NYS Museum, Peabody Museum) and other individuals with relevant collections to create or add to a library of voucher specimens from Long Island Sound at various life stages, as well as develop a digital archive accessible via the Internet.

Priority: Standard
Funding: TBD
FTE: TBD

4 E Establish Information Service

As more groups and organizations become involved in AIS monitoring, it is likely that there will be an associated increase in identification of new AIS. Reports of new AIS to appropriate parties in Connecticut and New York is necessary for identification and management purposes.

4 E 1 Develop a Reporting Center

State contacts have been designated for AIS reporting in Connecticut (CT DEP) and New York (NYS DEC); if they cannot identify a new species, they can make the appropriate referrals. Reporting of unusual sightings will be encouraged and information on how to contact them, as well as the type of information needed to locate and properly identify the organism, will be publicized via the LIS AIS web site, mailings to various groups such as fishermen, fishing associations, marinas, marine education organizations, etc. State contacts are responsible for sharing information on new sightings with the LIS AIS Coordinating Committee co-chairs.

Priority: Standard
Funding: <\$1K/year CT DEP and NYS DEC
FTE: <0.1 / year per agency (existing staff)

Objective 5: Initiate Risk Management

Risk management will be undertaken whenever the assessment of a new introduction or a new population of an existing invasive species indicates potential significant ecological or economic harm (Management Classes 1 or 2 with a rating of “High” or “Medium”). This includes the initiation of rapid response protocols to eradicate (first goal) or control / mitigate the effects (secondary goal).

5 A Develop/Adopt Rapid Response Protocols

The LIS AIS Coordinating Committee (or designated sub-committee) will review existing risk management protocols and procedures and adopt a protocol for LIS. This procedure of risk analysis and evaluation to determine an appropriate response will be employed whenever this is a newly identified species, an isolated range expansion, or major change in an existing AIS population.

5 A 1 Review / Assess Rapid Response Protocols

Taxa-specific response protocols for the control (including potential eradication) of newly-identified / detected priority invaders may exist for some marine species. The LIS AIS Coordinating Committee will delegate a sub-committee to review existing species-specific management plans and eradication case studies, and determine potential applicability to LIS. As new species are detected in the Sound, the Committee will assess the feasibility of rapid response measures, following its established protocols. Marine invasive species will be prioritized to reflect the distribution of the species and the realistic potential for control; the focus will be on Management Classes 1, 2, and 3.

Priority: High
Funding: < \$1K/year per agency
FTE: < 0.1 / year per agency

5 A 2 Develop Rapid Response and Control Guidelines for LIS (see Section 2.3.1)

Develop rapid response and control guidelines specific to LIS, to determine on case-by-case basis, whether any feasible options exist that can be implemented (see also 4 A 1). Establish control guidelines and recommendations that ensure that control resources are applied to feasible, cost-effective management projects in Long Island Sound.

Priority: High
Funding: <\$1K/year per agency
FTE: <0.1 / year per agency

5 B Support Rapid Response

Once a species is newly-identified in Long Island Sound (Management Classes 1 and 2), and where control (including eradication) is deemed feasible, the LIS AIS Coordinating Committee will support and assist any state (county / town/ federal)-directed marine rapid response effort.

5 B 1 Assist in Rapid Response

The LIS AIS Coordinating Committee will support and assist state AIS coordinators directing marine rapid response efforts. Consideration must be made to setting up “emergency response teams” with targeted funding available that can be tapped quickly to decrease the lag time between discovery and “response”.

Priority: High
Funding: TBD (probably high)
FTE: TBD

5 C Control Established AIS

If effective control techniques exist (e.g., Phragmites, Management Class 3), maintenance control of established AIS populations should be undertaken to preserve the recreational and biodiversity value of coastal and marine environments. The LIS AIS Coordinating Committee will support state-directed control efforts that have high potential for controlling AIS in LIS for more than a very short time period.

5 C 1 Support Site-Specific Control Efforts

Provide technical assistance for site-specific restoration efforts as needed. Support the continued development and implementation of state-directed site-specific control plans for established populations of AIS (Management Class 3), as well as a follow-up evaluation of the control plan effectiveness.

Priority: Standard
Funding: TBD
FTE: TBD

Objective 6: Education

Increase public awareness of AIS issues with respect to Long Island Sound.

6 A Facilitate Access to AIS Resources/Information/Contacts

Education and outreach programs regarding threats to Long Island Sound from AIS and the preventative measures necessary to limit their introduction will be expanded to target a wide variety of audiences / stakeholders. Access to resources, information, and general AIS-related educational materials for teachers and students, industry, agencies, legislators, and agency staff will be facilitated.

6 A 1 Revise and Expand AIS Website for LIS

The AIS LIS web pages will be revised, expanded, and enhanced to serve as the primary information site on LIS AIS Coordinating Committee activities and LIS AIS plan implementation. There will be contact information, links to state field reporting forms for the submission of potential new AIS sightings, periodic updates, timely AIS news releases, species alerts, and a calendar of events. Well-organized links to regional sites and federal, state, NGO websites, and sites with AIS resources will be included, and a variety of groups and organizations will be encouraged to link to the LIS AIS web site, to increase its visibility and use. It will also provide background information on priority marine invasive species in the region, and will link to primary sites in both states and associated databases.

Priority: High
Funding: CTSG \$6K year 1; <\$1K per year thereafter
FTE: 0.1 / year 1

6 A 2 Enhance, Utilize Existing AIS Educational Products

Appropriate materials and resources available through the regional panels, the Federal ANS Task Force, Sea Grant programs, national AIS campaigns (e.g., Habitattitude and Protect Your Waters), and other entities will be reviewed and utilized. Existing materials will be adapted for distribution via fishing tournaments, training courses, boat inspections, workshops, and meetings.

Priority: High
Funding: CTSG <\$5K per year; others TBD
FTE: CTSG <0.1 /year; others TBD

6 A 3 Develop LIS AIS Overview Presentation/Display

The LIS AIS Coordinating Committee will oversee development of one or more digital presentations and display materials outlining the AIS problem in Long Island Sound, general species of concern, common pathways or vectors, etc., and describing potential monitoring and management approaches. These presentations/display will be made available for use through the Coordinating Committee.

Priority: Standard
Funding: TBD
FTE: TBD

6 B Promote AIS Awareness through Education

Assistance from the general public will be necessary to limit the spread of AIS and for effective monitoring of priority invaders in LIS. The diffuse nature of the AIS problem and the wide variety of transport vectors requires resource managers, industry representatives, scientists, and the general public to be well-informed about potential pathways of introduction and spread. Targeted educational materials (such as watch cards or alerts) specific to LIS-designated priority AIS, pathways, and issues will be developed/adapted from existing resources, and distributed.

6 B 1 Develop and Distribute Educational Products

As needed, support the development of new or adaptation of existing educational materials (fact sheets, booklets, field cards, posters, etc.) and their widespread distribution to appropriate audiences; make available on the LIS AIS web site and distribute at regional conferences. Utilize national campaign materials to promote unified messages. Materials should address broad range of AIS topics related to Long Island Sound and target specific stakeholders, industries, the public, and K-12 teachers and students.

Priority: Standard
Funding: CTSG <\$2K per year; others TBD
FTE: CTSG <0.1 / year; others TBD

6 B 2 Promote AIS Education

Support and encourage efforts to educate a wide variety of audiences (boaters, anglers, divers, schools/teachers, community organizations, seafood industry on LIS AIS issues and reporting of potential AIS. Methods to include placards, signage, presentations, educational programs, training workshops, public service announcements, displays, web sites, articles, Connecticut and New York angler and boater guides, etc.

Priority: Standard
Funding: CTSG <\$5K per year; CT DEP ~\$20K per year, NYS DEC ~\$20K per year; others including public aquaria TBD
FTE: CTSG <0.1 / year, CT DEP <0.1 / year, NYS DEC <0.1/year, others TBD

6 B 3 Update Legislators and Agency Staff

Work with the state AIS coordinators and the LISS Policy Committee to ensure that periodic updates to state and federal legislators, legislative staff, and other agency staff on key AIS issues include those related to LIS. Develop a message that addresses predicted costs, risk analyses, and case studies for use in informing members of the state legislatures about AIS in LIS.

Priority: Standard
Funding: CT DEP <\$1K / year, NYS DEC < \$1K/year, NYS DOS < \$1K / year
FTE: CT DEP <0.1 / year, NYS DEC <0.1 / year, NYS DOS <0.1 / year

Objective 7: Research

7 A Promote AIS Research

Ongoing AIS research is vital to the success of the plan. Research assists in the determination of management priorities and increases the effectiveness of management efforts, can help to optimize resources, can bring about new methods for the detection, management, and control of AIS, and can assess ecological and economic impacts. Research priorities must be appraised periodically and updated to reflect changing needs, and scientists and managers in the region should be kept informed and encouraged to address these priorities.

7 A 1 Promote Research Priorities

The list of research and monitoring priorities, and economic impact assessments developed by the LIS AIS Coordinating Committee will be shared with local and regional research institutions and funding agencies.

Priority: High
Funding: All <\$1K/year
FTE: All <0.1/year

7 A 2 Facilitate Funding of Research Projects

Develop and maintain an online, up-to-date listing that identifies various federal, state, and private funding opportunities for AIS research.

Priority: High
Funding: All <\$1K/year (for listing)
FTE: All <0.1 / year (for listing)

7 B Identify Existing Research Efforts

Many individuals and groups are researching a variety of AIS in Long Island Sound, but there is a lack of broader awareness of individual efforts. Greater visibility of ongoing research efforts may help to expand our knowledge by minimizing redundant research and building complementary partnerships.

7 B 1 Identify On-going AIS Research Projects in LIS

Create and maintain a list of on-going AIS research projects in LIS and their associated principal investigators. Post on LIS AIS web site.

Priority: High
Funding: CTSG, NYSG, EPA LISS < \$1K / year
FTE: <0.1 / year

- Benoit, L. Use genetic markers to track spread of *Hydrilla verticillata* and identify herbicide resistant populations. University of Connecticut.
- Brousseau, D. Fairfield University.
- Bullard, S. University of Hartford.
- Heinonen, K. and P. Auster. Effects of *Hemigrapsus sanguineus* on the crustacean-feeding guild of fishes in Long Island Sound. University of Connecticut.
- Hudson, D. Physiological and behavioral characteristics that give *Hemigrapsus sanguineus* a distinct advantage against predation and desiccation; primarily, chemical recognition of conspecifics, and which environmental conditions are more likely to produce expected behavioral change (aggregation). University of Connecticut.
- Prислоe, S., M. Gilmore, N. Barrett, E. Wilson, J. Hurd, D. Civco, R. Zajac, and C. Chadwick. Investigating the use of remote sensing, using digital imagery acquired from satellites and airborne sensors, to classify high-resolution images to identify existing stands of *Phragmites australis* and other vegetation types, to map and treat quantified areas, and to monitor long-term vegetation changes. University of Connecticut, Wesleyan University, USDA Natural Resources Conservation Service and University of New Haven.
- Reinhardt, J. University of Connecticut. Ontogenetic changes in the material properties of *Didemnum* sp. A. Understanding fragmentation as a mechanism of dispersal. - supported by Uconn Center for Environmental Sciences and Engineering and Sounds Conservancy.
- Stefaniak, L., H. Zhang, R. Whitlatch, and G. Lambert. Alternatives to mitochondrial markers for phylogenetics and population genetics in *Didemnum* sp. University of Connecticut and University of Washington
- Whitlatch, R., S. Shumway, C. Adams, and T. Getchis. Control and economics of aquatic invasive species in marine aquaculture. University of Connecticut and University of Florida Cooperative Extension.
- Whitlatch, R. and R. Osman. Factors influencing invader success in coastal ecosystems. University of Connecticut and Smithsonian Environmental Research Center.
- Whitlatch, R., R. Osman, and N. Balcom. Recreational vessel hull fouling as a transport vector for aquatic invasives. University of Connecticut and Smithsonian Environmental Research Center
- Yarish, C., R. Whitlatch, G. Kraemer, and S. Lin. Multi-component evaluation to minimize the spread of aquatic invasive seaweeds and harmful algal bloom microalgae via live bait vectors in Long Island Sound. University of Connecticut and State University of New York (SUNY), Purchase.
- Yarish, C., R. Whitlatch, G. Kraemer, S. Lin, R. Gladych, and N. Blasik. Impacts and spread of non-indigenous Rhodophycean alga, *Grateloupia turuturu*, on Long Island Sound. University of Connecticut and State University of New York (SUNY), Purchase.

Objective 8: Legislation, Regulation and Policy

Review existing LIS-related agreements, laws, and regulations and identify those that may be strengthened or revised to ensure comparability between the states in addressing potential AIS vectors. Through the LISS Management and Policy Committees, adopt this plan as basis of a Memorandum of Agreement for addressing the problems associated with aquatic invasive species in Long Island Sound.

8 A Assess and Strengthen Existing Authorities

The waters of Long Island Sound are under the jurisdiction of New York, Connecticut, and the United States government. Numerous agreements, laws, and regulations pertaining to AIS management are already in place, but these must be evaluated and coordinated to identify potentially unregulated pathways for new invasions, and to determine comparability between the states.

8 A 1 Review Existing Authority

Review and evaluate existing agreements, laws, and regulations and assess whether gaps or inequities exist, particularly in regard to potentially unregulated or unaddressed pathways for new invasions.

Priority: Standard
Funding: CT DEP < \$1K / year, CT DABA <\$1K/ year, NYS DEC < \$1K/ year,
NYS DOS < \$1K/year, EPA LISS < \$1K/ year
FTE: All <0.1 / year each

8 A 2 Strengthen Existing Regulatory Efforts and Legislation

The States of Connecticut and New York should elevate in priority the review, oversight, and enforcement of regulations that could prevent inadvertent introductions of AIS (including importation, possession, and live release permit regulations for live fish and eggs, other vertebrate species, invertebrate species, and marine macrophytes). Required protocols for quarantine and release prevention should be reviewed and enforced, as well as regulated discharges from research and educational institutions. Response actions to violations must be coordinated with law enforcement personnel. Encourage enforcement of existing federal and state regulations at all levels. If inequities exist between Connecticut and New York regulations or legislation that affect AIS pathways into or out of Long Island Sound, explore means for making them comparable. If gaps in authority exist and educational programs cannot fill the need, work with the states to address them through new legislation or regulations. Encourage parallel legislation.

Priority: High
Funding: States of CT and NY (on-going); EPA (on-going)
FTE: 0.2 / year (mostly existing staff time)

8 A 3 Support New AIS Regulations or Legislation

As needed, develop and adopt new regulations to address AIS concerns. Strive for comparable regulations between Connecticut and New York. Ongoing management of AIS in Long Island Sound may lead to the discovery of new problems that require legislative control. General recommendations for additional state and federal legislation to minimize the impacts of AIS will be developed as necessary.

Priority: Standard
Funding: CT DEP < \$1K / year, CT DABA <\$1K/ year, NYS DEC < \$1K/ year, NYS
DOS < \$1K/year, EPA LISS < \$1K/ year
FTE: All <0.1 / year each

SECTION 6. IMPLEMENTATION TABLE

Task ID	Task Name	Funding Source	Implementing Entities	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
					2006 CY	2007 CY	2008 CY	2009 CY	2010 CY	2011 CY
1	Coordinate									
1A	Establish Coordinating Entities									
1A1	Establish Coordinating Committee	EPA LISS	EPA LISS, CT DEP, NYS DEC	LISS partners	N/A	N/A	< \$2K / < 0.1	N/A	N/A	N/A
1B	Coordinate Within the LIS Region									
1B1	Coordinate with CT and NY ANS / AIS Management Plans	CT DEP	CT DEP, NYS DEC, EPA LISS	Coordinating Committee	N/A	N/A	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1
		NYS DEC	CT DEP, NYS DEC, EPA LISS	Coordinating Committee	N/A	N/A	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1
		EPA LISS	CT DEP, NYS DEC, EPA LISS	Coordinating Committee	N/A	N/A	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1
		Coordinating Committee members	Coordinating Committee members	EPA LISS, CT DEP, NYS DEC	N/A	N/A	< \$1K / < 0.1 each	< \$1K / < 0.1 each	< \$1K / < 0.1 each	< \$1K / < 0.1 each
1B2	Develop Risk Assessment, Management, and Policy Procedures	EPA LISS	CT DEP, NYS DEC, EPA LISS	Coordinating Committee	N/A	N/A	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1
		NYS DEC	CT DEP, NYS DEC, EPA LISS	Coordinating Committee	N/A	N/A	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1
		CT DEP	CT DEP, NYS DEC, EPA LISS	Coordinating Committee	N/A	N/A	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1
		Coordinating Committee members	Coordinating Committee members	EPA LISS, CT DEP, NYS DEC	N/A	N/A	< \$1K / < 0.1 each	< \$1K / < 0.1 each	< \$1K / < 0.1 each	< \$1K / < 0.1 each

Task ID	Task Name	Funding Source	Implementing Entities	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
					2006 CY	2007 CY	2008 CY	2009 CY	2010 CY	2011 CY
1B3	Establish Annual Work Plan	Coordinating Committee members	Coordinating Committee members	EPA LISS, CT DEP, NYS DEC	N/A	N/A	< \$1K / < 0.1 each	< \$1K / < 0.1 each	< \$1K / < 0.1 each	< \$1K / < 0.1 each
		EPA LISS	EPA LISS, CT DEP, NYS DEC	Coordinating Committee	N/A	N/A	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1
		CT DEP	EPA LISS, CT DEP, NYS DEC	Coordinating Committee	N/A	N/A	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1
		NYS DEC	EPA LISS, CT DEP, NYS DEC	Coordinating Committee members	N/A	N/A	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1
1B43	Evaluate AIS Program	EPA LISS	EPA LISS, CT DEP, NYS DEC	Coordinating Committee	N/A	N/A	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1
		CT DEP	EPA LISS, CT DEP, NYS DEC	Coordinating Committee	N/A	N/A	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1
		NYS DEC	EPA LISS, CT DEP, NYS DEC	Coordinating Committee	N/A	N/A	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1
1C	Coordinate Beyond the LIS Region									
1C1	Coordinate Regionally	CTSG	CTSG	NEANS Panel	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1
		NYSG	NYSG	NEANS Panel	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1
		CT DEP	CT DEP	NEANS Panel	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1
		NYS DEC	NYS DEC	NEANS Panel	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1
		USFWS (ANS)	NEANS panel reps	NEANS Panel	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1	<\$2K / <0.1

Task ID	Task Name	Funding Source	Implementing Entities	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
					2006 CY	2007 CY	2008 CY	2009 CY	2010 CY	2011 CY
1C2	Encourage Reporting	EPA LISS	CT DEP, NYS DEC	Coordinating Committee	N/A	N/A	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1
		CT DEP	CT DEP, NYS DEC	Coordinating Committee	N/A	N/A	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1
		NYS DEC	CT DEP, NYS DEC	Coordinating Committee	N/A	N/A	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1
		Misc.	Research community		N/A	N/A	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1
2	Fund									
2 A	Fund AIS Management Program									
2A1	Identify and Secure Funding	TBD	EPA LISS	CT DEP, NYS DEC, others	N/A	N/A	TBD / 0.2	TBD / 0.2	TBD / 0.2	TBD / 0.2
		TBD	CT DEP	EPA LISS, NYS DEC, others	N/A	N/A	TBD / 0.2	TBD / 0.2	TBD / 0.2	TBD / 0.2
		TBD	NYS DEC	EPA LISS, CT DEP, others	N/A	N/A	TBD / 0.2	TBD / 0.2	TBD / 0.2	TBD / 0.2
3	Prevent Future Anthropogenic Introductions									
3 A	Assess and Minimize Introduction Risks									
3A1	Assess Introduction Risks	TBD	Coordinating Committee	TBD	N/A	N/A	TBD	TBD	TBD	TBD
		EPA LISS	CTSG	NEIWPCC, CTSG	\$6K / .25	N/A	N/A	N/A	N/A	N/A
		CTSG	CTSG	EPA LISS, NEIWPCC	\$6 K / .25	N/A	N/A	N/A	N/A	N/A
		NEIWPCC	CTSG	EPA LISS, CTSG	N/A	\$6 K / .25	N/A	N/A	N/A	N/A

Task ID	Task Name	Funding Source	Implementing Entities	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
					2006 CY	2007 CY	2008 CY	2009 CY	2010 CY	2011 CY
3B	Minimize Marine Commerce Introductions									
3B1	Minimize Introductions through Commercial Shipping	USCG	USCG	Port authorities, shipping companies	On-going	On-going	On-going	On-going	On-going	On-going
		TBD	Coordinating Committee	USCG, port authorities, local marinas and shipyards, CT DEP, CT DOT, NYS DOT, NYSG, CTSG, Clean Marina progs	N/A	N/A	TBD	TBD	TBD	TBD
3B2	Minimize Aquaculture / Hatchery Introductions	CT DA/BA	CT DA/BA	CT DEP, CTSG, NYSG, NYS DEC, industry	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1
		CT DEP	CT DEP	CT DA/BA, CTSG, NYSG, NYS DEC, industry	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1
		CTSG	CTSG	CT DA/BA, CT DEP, industry, NYSG	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1
		NYS DEC	NYS DEC	CT DA/BA, CT DEP, NYSG, industry	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1
		NYSG	NYSG	NYS DEC, CTSG, industry	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1
3B3	Minimize Commercial Bait Industry Introductions (see also 3 C 2)	CT DEP	CT DEP	NYS DEC	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		NYS DEC	NYS DEC	CT DEP	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		EPA LISS, CTSG	UCONN, SUNY Purchase	Bait dealers, bait wholesalers	\$102K over 15 months	N/A	N/A	N/A	N/A	N/A

Task ID	Task Name	Funding Source	Implementing Entities	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
					2006 CY	2007 CY	2008 CY	2009 CY	2010 CY	2011 CY
3B4	Minimize Pet Trade Introductions	TBD	Coordinating Committee	TBD	N/A	N/A	TBD	TBD	TBD	TBD
		CTSG, NSGO	CTSG	EPA LISS, USFWS (Habitattitude, Protect Your Waters)	\$3.5K / <0.1	\$6K / <0.1	N/A	N/A	N/A	N/A
		EPA	NYSG	Peconic Estuary Prog	\$XX	N/A	N/A	N/A	N/A	N/A
3C Minimize Marine Recreation Introductions										
3C1	Minimize Recreational Boating Introductions through Hull Fouling	CT DEP	CT DEP		<\$3K / 0.1	<\$3K / 0.1	<\$3K / 0.1	<\$3K / 0.1	<\$3K / 0.1	<\$3K / 0.1
		NSGO, CTSG	CTSG	Northeast Sea Grant programs	\$5K / < 0.1	\$5K / < 0.1	N/A	N/A	N/A	N/A
		TBD	NYS OPRHP	TBD	N/A	N/A	TBD	TBD	TBD	TBD
3C2	Minimize Bait Introductions through Angling (see also 3 B 3)	EPA LISS, CTSG	UCONN, SUNY Purchase	Bait dealers, bait wholesalers	\$102K over 15 months		N/A	N/A	N/A	N/A
		NSGO, CTSG	CTSG	Northeast Sea Grant programs	\$5K / < 0.1	\$5K / < 0.1	N/A	N/A	N/A	N/A
3D Minimize Introductions by Education and Research										
3 D 1	Promote Established Research Protocols	Misc.	Coordinating Committee	CTSG, NYSG, EPA LISS, others	N/A	N/A	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1
3 D 2	Encourage Aquaria AIS BMPs	TBD	Coordinating Committee	Public aquaria	N/A	N/A	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1
3 D 3	Minimize Consumer Introductions through Biological Shipments	TBD	TBD	NYSMEA, SENEME, CSTA, NYSTA	N/A	N/A	TBD	TBD	TBD	TBD
3E Minimize Introductions through Live Seafood Trade										
3 E 1	Promote Proper Use & Disposal of Live Seafood	TBD	TBD	MIT Sea Grant, Northeast SG Programs	N/A	N/A	TBD	TBD	TBD	TBD

Task ID	Task Name	Funding Source	Implementing Entities	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
					2006 CY	2007 CY	2008 CY	2009 CY	2010 CY	2011 CY
3 F Minimize Introductions through Habitat Restoration										
3 F 1	Minimize AIS Introductions during Restoration	TBD	TBD	NYS OPRHP	N/A	N/A	TBD	TBD	TBD	TBD
		USDA NRCS WHIP cost-share program	Lynde Point (CT) Land Trust	CTSG, All Habitat Inc.	N/A	\$62,575	See 2007	See 2007	See 2007	See 2007
		USDA NRCS WHIP cost-share program	Lynde Point (CT) Land Trust	CTSG, All Habitat Inc.	\$13,370 (2004-2006)	N/A	N/A	N/A	N/A	N/A
		USDA NRCS WHIP cost-share program	Lynde Point (CT) Land Trust	CTSG, All Habitat Inc.	\$35,000	See 2006	See 2006	See 2006	See 2006	N/A
4 Detect and Monitor										
4 A Strategize Early Detection, Monitoring and Assessment										
4A1	Develop EDMA Strategic Plan / Protocol / Procedure	Sub-committee members	Coordinating Committee sub-committee	LISS partners, research & education institutions, NGOs, industry	N/A	N/A	<\$1K / < 0.1 each	N/A	N/A	N/A
4B Standardize Survey Protocol										
4B1	Develop Standardized Approach	Misc.	Coordinating Committee	LISS partners, research and education institutions, NGOs, industry	N/A	N/A	<\$1K / < 0.1 each	N/A	N/A	N/A
4B2	Develop a Quality Assurance / Quality Control Protocol	TBD	Coordinating Committee	TBD	N/A	N/A	<\$1K / < 0.1 each	N/A	N/A	N/A
4C Implement Monitoring Program										
4 C 1	Develop and Train New Monitors	TBD	Coordinating Committee sub-committee	Recreational divers, commercial fishermen, anglers, coastal land	N/A	N/A	<\$1K / < 0.1 each	<\$1K / < 0.1 each	<\$1K / < 0.1 each	<\$1K / < 0.1 each

				owners, parks, land trusts, marinas, school & scout groups, NGOs						
4 C 2	Conduct and Evaluate Monitoring	Misc.	Coordinating Committee	Trained monitoring groups	N/A	N/A	<\$1K / < 0.1 each	<\$1K / < 0.1 each	<\$1K / < 0.1 each	<\$1K / < 0.1 each

Task ID	Task Name	Funding Source	Implementing Entities	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
					2006 CY	2007 CY	2008 CY	2009 CY	2010 CY	2011 CY
4 D Create Library of Existing AIS										
4 D 1	Maintain and Update Library of Existing AIS	TBD	Coordinating Committee designee	NYS Museum, Peabody Museum, others	N/A	N/A	TBD	TBD	TBD	TBD
4E Establish Information Service										
4 E 1	Develop a Reporting Center	CT DEP	CT DEP	CTSG, NYS DEC, NYSG	N/A	N/A	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1
		NYS DEC	NYS DEC	CTSG, CT DEP, NYSG	N/A	N/A	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1
5 Initiate Risk Management										
5 A Develop / Adopt Rapid Response Protocols										
5A1	Review / Assess Rapid Response Protocols	Misc.	Coordinating Committee	Sub-committee members	N/A	N/A	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1
5A2	Develop Rapid Response and Control Guidelines for LIS	CT DEP	CT DEP, NYS DEC, Coordinating Committee	Coordinating committee members, other state and federal agencies	N/A	N/A	<\$1K / <0.1	<\$1K / <0.1	TBD	TBD
		NYS DEC	CT DEP, NYS DEC, Coordinating Committee	Coordinating committee members, other state and federal agencies	N/A	N/A	<\$1K / <0.1	<\$1K / <0.1	TBD	TBD

5B Support Rapid Response										
5B1	Assist in Rapid Response	TBD	CT DEP, NYS DEC, other state agencies	EPA LISS partners, Coordinating Committee	N/A	N/A	TBD	TBD	TBD	TBD

Task ID	Task Name	Funding Source	Implementing Entities	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
					2006 CY	2007 CY	2008 CY	2009 CY	2010 CY	2011 CY

5C Control Established ANS										
5C1	Develop Site-Specific Control Efforts	TBD	CT DEP, NYS DEC, NYS OPRHP, CT DA/BA	Coordinating committee						
		CT DEP, USDA NRCS, other	CT DEP, WHAMM		\$50,000	\$400,000	TBD	TBD	TBD	TBD
			NYS OPRHP	NYS DEC, NYS DOS, Town of Smithtown, Suffolk County, The Nature Conservancy, LIISMA	N/A	N/A	Nissequogue River State Park (\$100K) Sunken Meadow State Park (\$100K)	TBD	TBD	
			NYS OPRHP	NYS DEC, NYS DOS, Town of Smithtown, Suffolk County, The Nature Conservancy, LIISMA	N/A	N/A	~\$1M to assess and control invasive plants and aquatic plant growth; development of comprehensive management plan, for Webster, Upper Vail, Lower Vail, and Willow Ponds			

6 Education										
6 A Facilitate Access to AIS Resources / Information / Contacts										
6A1	Revise and Expand AIS Website for LIS	CTSG	CTSG	Coordinating Committee members	N/A	N/A	\$6K / <0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1

6A2	Enhance, Utilize Existing AIS Educational Products	CTSG	CTSG		<\$5K/<0.1	<\$5K/<0.1	<\$5K/<0.1	<\$5K/<0.1	<\$5K/<0.1	<\$5K/<0.1
6A3	Develop LIS AIS Overview Presentation / Display	TBD	Coordinating Committee	EPA LISS partners	N/A	N/A	<\$1K/<0.1	<\$5K/<0.1	<\$5K/<0.1	<\$5K/<0.1
Task ID	Task Name	Funding Source	Implementing Entities	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
					2006 CY	2007 CY	2008 CY	2009 CY	2010 CY	2011 CY
6B	Promote AIS Awareness through Education									
6B1	Develop and Distribute Educational Products	CTSG, NSGO	CTSG	EPA LISS, USFWS (Habitattitude, Protect Your Waters)	\$3.5K / <0.1	\$6K / <0.1	N/A	N/A	N/A	N/A
6B2	Promote AIS Education	CTSG	CTSG		<\$5K / <0.1	<\$5K / <0.1	<\$5K / <0.1	<\$5K / <0.1	<\$5K / <0.1	<\$5K / <0.1
		CT DEP	CT DEP		~\$20K / <0.1	~\$20K / <0.1	~\$20K / <0.1	~\$20K / <0.1	~\$20K / <0.1	~\$20K / <0.1
		NYS DEC	NYS DEC	NYS OPRHP						
		NYSG	NYSG							
		EPA LISS	EPA LISS							
		Mystic Aquarium and Institute for Exploration	Mystic Aquarium and Institute for Exploration							
		Maritime Aquarium at Norwalk	Maritime Aquarium at Norwalk							
		SoundWaters	SoundWaters							

Task ID	Task Name	Funding Source	Implementing Entities	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
					2006 CY	2007 CY	2008 CY	2009 CY	2010 CY	2011 CY
6B3	Update Legislators and Agency Staff	CT DEP	CT DEP	CT DA/BA, NYS DEC, NYS DOS, EPA LISS	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		CT DA/BA	CT DA/BA	CT DEP, NYS DEC, NYS DOS, EPA LISS	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		NYS DEC	NYS DEC	CT DEP, CT DA/BA, NYS DOS, EPA LISS	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		NYS DOS	NYS DOS	CT DEP, CT DA/BA, NYS DEC, EPA LISS	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		EPA LISS	EPA LISS	CT DEP, CT DA/BA, NYS DEC, NYS DOS	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
7	Research									
7 A	Promote AIS Research									
7A1	Promote Research Priorities	EPA LISS	Coordinating Committee	EPA LISS partners	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		CTSG	CTSG	EPA LISS partners	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		NYSG	NYSG	EPA LISS partners	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		NYS DEC	NYS DEC	EPA LISS partners	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		CT DEP	CT DEP	EPA LISS partners	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
7A2	Facilitate Funding of Research Projects	EPA LISS	Coordinating Committee	EPA LISS partners	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1

Task ID	Task Name	Funding Source	Implementing Entities	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
					2006 CY	2007 CY	2008 CY	2009 CY	2010 CY	2011 CY
7B	Coordinate Existing Research Efforts									
7B1	Identify On-going AIS Research Projects in LIS	CT DEP, CTSG, UCONN	UCONN (L. Benoit)		CT DEP \$7400; CTSG \$1500 / 0.5	CT DEP \$7400 / 0.5	TBD	TBD	TBD	
		NURC; UCONN, QLF Sounds Conservancy, EPA LISS, Rankin Award, Intl Women's Fishing Assoc.	UCONN (K. Heinonen)		Rankin Award \$250; Intl Women's Fishing Assoc \$1,000 / .5	TBD	TBD	N/A	N/A	N/A
		EPA LISS, CTSG	UCONN (C. Yarish, R. Whitlatch, S. Lin); SUNY Purchase (G. Kraemer)		\$42,071	\$59,685	N/A	N/A	N/A	N/A
		CTSG	UCONN (C. Yarish, R. Whitlatch, S. Lin, R. Gladych, N. Blascik); SUNY Purchase (G. Kraemer)	Dominion Nuclear Connecticut, Millstone Environmental Lab	\$125,880	\$121,955	N/A	N/A	N/A	N/A
		NSGO, CTSG	UCONN (R. Whitlatch, S. Shumway, T. Getchis), Univ. of Florida (C. Adams)	Shellfish industry, CTSG	\$222,731	\$225,678	N/A	N/A	N/A	N/A
		UCONN Ctr for Environmental	UCONN (J. Reinhardt)							

		Sciences & Engineering, Sounds Conservancy								
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Task ID	Task Name	Funding Source	Implementing Entities	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
					2006 CY	2007 CY	2008 CY	2009 CY	2010 CY	2011 CY
8	Legislation, Regulation, and Policy									
8 A	Assess and Strengthen Existing Authorities									
8A1	Review Existing Authority	CT DEP	CT DEP	EPA LISS partners	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		CT DA/BA	CT DA/BA	EPA LISS partners	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		NYS DEC	NYS DEC	EPA LISS partners	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		NYS DOS	NYS DOS	EPA LISS partners	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		EPA LISS	EPA LISS	EPA LISS partners	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
8A2	Strengthen Existing Regulatory Efforts and Legislation	State of CT	State of CT	NY , EPA, USFWS	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		State of NY	State of NY	CT, EPA, USFWS	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		EPA	EPA	CT, NY, USFWS	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		USFWS	USFWS	CT, NY, EPA	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
8A3	Support New AIS Regulations or Legislation	CT DEP	CT DEP	EPA LISS partners	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		CT DA/BA	CT DA/BA	EPA LISS partners	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		NYS DEC	NYS DEC	EPA LISS partners	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		NYS DOS	NYS DOS	EPA LISS partners	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		EPA LISS	EPA LISS	EPA LISS partners	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		CT DEP	CT DEP	EPA LISS partners	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1

SECTION 7. PROGRAM MONITORING AND EVALUATION

Following submission of this management plan to the Federal ANS Task Force, the AIS Coordinating Committee will generate the first annual work plan based on tasks identified above. Successful implementation of the plan will be evaluated annually by the Coordinating Committee, based both on progress in meeting the plan objectives as well as completing identified tasks. Due to the difficulty in assigning quantitative measures of progress towards these goals, the AIS Coordinating Committee will evaluate plan implementation based primarily on the completion of specific tasks identified for each year (see Implementation Table). Results of the evaluation will be summarized in an annual report that will include:

1. A qualitative description of progress towards each objective
2. A complete list of tasks identified in the previous year's work plan, budgetary needs identified for each, amount of resources procured, and resources expended.
3. Designation of the implementation status (full, partial, or not implemented) of each task identified in the previous year's work plan and a brief justification of the designation.
4. A summary of resource requirements to achieve full implementation of tasks listed as partially or not implemented.

Evaluation of annual work plans will play a major role in directing activities for the following years and securing funding, as well as restructuring tasks identified in the original plan. Work plans for upcoming years will be produced concurrently with each annual program evaluation document.

GLOSSARY

This plan relies on the definitions outlined in federal Executive Order 13112, signed by President Clinton in 1999. (*Note: The term “nuisance” is used in the Connecticut ANS Management Plan instead of “invasive,” the terminology used in the original Act (NANPCA) passed by Congress in 1990. However, nationally, “invasive” includes both aquatic and terrestrial species and has largely replaced the term “nuisance” and thus is used for this plan. The terminology adopted in the Final Report of the New York State Invasive Species Task Force (2005) is that which was outlined in federal EO 13112.*)

alien species	Any species including its seeds, eggs, spores or other biological material capable of propagating that species, that is not native to a particular ecosystem. (See nonindigenous, introduced, exotic).
aquaculture	Cultivation, grow-out or distribution of aquatic organisms for stocking, liberation, or as food; includes commercial hatcheries.
aquatic	For the purposes of this plan, any species that must spend some part or all of its lifecycle in mesohaline (5 ppt), brackish, estuarine, or marine water or wetlands.
ballast water	Water taken on by transoceanic ships to help maintain stability during transit of ocean or coastal waters. As ships take on or off-load cargo, they fill or discharge from their ballast tanks thousands to millions of gallons of water. Ballast water is considered a significant vector for the transport and introduction of species worldwide.
control	Eradicating, suppressing, reducing, or managing invasive species populations as appropriate, preventing spread of invasive species from areas where they are present, and taking steps such as restoration of native species and habitats to reduce the effects of invasive species and to prevent further invasions.
cryptogenic species	Based on available information, it is unclear whether an organism is of native or non-native origin.
cultch	Dry shell (usually oyster) that is deposited on oyster grounds prior to the spawning season to provide suitable substrate to attract settling larval oysters. This technique is used to enhance the success of the spawning season.
early detection	A comprehensive, integrated system of active and passive surveillance to find and verify the identity of new invasive species as early as possible, when eradication and control are still feasible and less costly. It may be targeted at areas where introductions are likely and/or sensitive ecosystems. (from Review of Systems for Early Detection and Rapid Response, National Invasive Species Council, 2002)
established	A species occurring as a reproducing, self-sustaining population in an open ecosystem
exotic	Non-native organism, see alien, introduced, non-indigenous.
indigenous species	A species that is native to a particular region or ecosystem; see native species
introduced species	Non-native species or nonindigenous species; a species that has successfully established in a new habitat to which it was introduced, intentionally or inadvertently (also called alien or exotic species)
introduction	The intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity.
invasive species	An alien or introduced species whose introduction does or has the potential to cause significant economic or environmental harm or harm to human health; a nonindigenous species that threatens the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural, aquacultural, or recreational activities dependent upon such waters; also called nuisance species; invader.
native species	A species that, other than the result of an introduction, historically occurred or currently occurs in a particular ecosystem. See indigenous.
newly identified species	A known species that has been reported in a new location
new species	A newly-identified and described species to science
nonindigenous species	Any species or other viable biological material that enters an ecosystem beyond its historic range, including any such organism transferred from one country into another. Nonindigenous species include both exotics and transplants. Synonyms include <i>introduced, foreign, exotic, alien, non-native, immigrant and transplants.</i>
rapid response	A systematic effort to eradicate, contain or control invasive species while infestation is still localized; may be implemented in response to new introduction or to isolated population of previously established invasive species. Preliminary assessment and subsequent monitoring may be part of the response.

LIST OF ACRONYMS

Acronym	Definition
AIS	Aquatic invasive species
ANS	Aquatic nuisance species
ANSTF	Aquatic Nuisance Species Task Force (federal)
APHIS	Animal and Plant Health Inspection Service (USDA)
ASMFC	Atlantic States Marine Fisheries Commission
CAES	Connecticut Agricultural Experiment Station
CIPWG	Connecticut Invasive Plant Working Group
CT DA	Connecticut Department of Agriculture
CT DA/BA	Connecticut Dept. of Agriculture, Bureau of Aquaculture
CTSG	Connecticut Sea Grant, University of Connecticut
CT DEP	Connecticut Department of Environmental Protection
CT DEP BNR	Connecticut Department of Environmental Protection, Bureau of Natural Resources
DHS	U.S. Department of Homeland Security
DOT/ CT DOT	Connecticut Department of Transportation
DPH/ CT DPH	Connecticut Department of Public Health
EEB	Department of Ecology and Evolutionary Biology, University of Connecticut
EDMA	Early Detection, Monitoring and Assessment
EPA	U.S. Environmental Protection Agency
FDA	U.S. Food and Drug Administration
GSC	General Statutes of Connecticut
IPANE	Invasive Plant Atlas of New England
IPC	Invasive Plant Council (CT)
ISAC	Invasive Species Advisory Committee (federal)
ISTF	Invasive Species Task Force (New York)
LIS	Long Island Sound
LIISMA	Long Island Invasive Species Management Area
LISS	Long Island Sound Study (EPA National Estuary Program)
NANPCA	Nonindigenous Aquatic Nuisance Prevention and Control Act
NEANS Panel	Northeast regional Aquatic Nuisance Species Panel
NERR	National Estuarine Research Reserve
NEIWPPC	New England Interstate Water Pollution Control Commission
NISC	National Invasive Species Council
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service (NOAA)
NRCS	Natural Resource Conservation Service (USDA)
NYS DAM	New York State Department of Agriculture and Markets
NYS DEC	New York State Department of Environmental Conservation
NYS DOS	New York State Department of State
NYS DOT	New York State Department of Transportation
MYSISTF	New York State Invasive Species Task Force
NYS OPRHP	New York State Office of Parks, Recreation, and Historical Preservation
OLISP	CT DEP Office of Long Island Sound Programs
PRISM	Partnership for Regional Invasive Species Management
RCSA	Regulations of Connecticut State Agencies
TNC	The Nature Conservancy
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

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Additional Internet Resources

<http://www.anstaskforce.gov/default.php>

Aquatic Nuisance Species Task Force

<http://www.invasivespeciesinfo.gov/>

National Invasive Species Information Center, USDA National Agricultural Library

<http://www.invasivespeciesinfo.gov/council/main.shtml>

National Invasive Species Council

<http://nas.er.usgs.gov/>

USGS Nonindigenous Aquatic Species

<http://biology.usgs.gov/invasive/>

USGS, Biology Invasive Species Program

<http://www.issg.org/database/welcome/>

Global Invasive Species Database

<http://www.gisnetwork.org/>

Global Invasive Species Information Network

<http://www.northeastans.org/>

Northeast Aquatic Nuisance Species Panel

<http://www.midatlanticpanel.org/>

Mid-Atlantic Panel on Aquatic Invasive Species

<http://www.habitattitude.net/>

Habitattitude (USFWS/NOAA)

<http://www.protectyourwaters.net/>

Protect Your Waters (USFWS)

<http://invasives.eeb.uconn.edu/ipane/>

Invasive Plant Atlas of New England

www.ipcnys.org/

Invasive Plant Council of New York State

<http://chartis.mit.edu/mitis/>

MIT Sea Grant Marine Invader Tracking Information System

<http://chartis.mit.edu/website/invasives/viewer.htm>

MIT Sea Grant Invasive Species Sightings

www.algae.uconn.edu

Digital database, seaweeds in Long Island Sound (includes both herbarium sheets and images)

www.algae.base.org

World's largest database of seaweeds, maintained by the National University of Ireland, Galway